# THE JOURNAL OF GAS LIGHTING
## WATER SUPPLY & SANITARY IMPROVEMENT

VOL. XCII. No. 2221.] LONDON, DECEMBER 5, 1905. [57TH YEAR. PRICE 6d.



**PARKER & LESTER,**

— *ESTABLISHED 1830.* —

MANUFACTURERS AND CONTRACTORS. **ORMSIDE STREET, LONDON, S.E.**

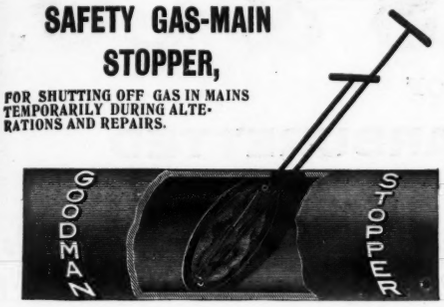
THE ONLY MAKERS OF

**PATENT ANTIMONY PAINT & PARKER'S IMPERIAL BLACK VARNISH.**

OXIDE PAINTS, OILS, AND GENERAL STORES, FOR GAS AND WATER WORKS.

**SAFETY GAS-MAIN STOPPER,**

FOR SHUTTING OFF GAS IN MAINS TEMPORARILY DURING ALTERATIONS AND REPAIRS.




SHORT'S PATENT

**GAS-LEAK INDICATORS.**

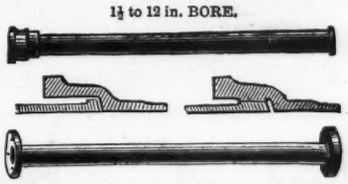
FOR GROUND USE. FLUSH BOXES ETC. HIGHLY SENSITIVE. LONG-RANGE.

FOR PURIFIER BLOW-OFF VALVES. FOR HARD USAGE.

WITH ALL LATEST IMPROVEMENTS.

**GAS AND WATER PIPES**

1½ to 12 in. BORE.



**THOMAS ALLAN & SONS,** LIMITED,

**Bonlea Foundry,**

THORNABY-ON-TEES.

Formerly Springbank Iron-Works, Glasgow.

ESTABLISHED 1848.

Also Manufacturers of

SANITARY AND RAIN-WATER PIPES, HOT WATER PIPES, STABLE FITTINGS, RANGES STOVES, AND GENERAL CASTINGS.

Telegrams: "BONLEA, THORNABY-ON-TEES."

**NORTON'S PATENT**

# "ABYSSINIAN" & ARTESIAN TUBE WELLS,

FOR TOWN WATER-WORKS AND OTHER SUPPLIES.

The following Town Water-Works Supplies have been obtained by this System, viz.:—Abbott's Langley, Aldershot, Alnwick, Cirencester, Hertford, Lechlade, St. Albans, Shrewsbury, Skegness, Southampton, Stony Stratford, Swansea, Wallingford, Watford, West Worthing, Wimborne, &c.

**LE GRAND & SUTCLIFF,**

HYDRAULIC ENGINEERS, 100, BUNHILL ROW, LONDON, E.C.

# 13,000

**FURNACES**

**FITTED.**

CHEAP STEAM PRODUCTION.

TO THE EDITOR OF ENGINEERING.

SIR,—Some years ago we attached forced draught and special fire-bars to our two Lancashire boilers, with the object of burning coke dust. The load has grown, and last week I had the water and fuel carefully checked, with the following results:—

| | | | |
|---|---|---|---|
| Water used in boilers from Dec. 9 to Dec. 16, as per Corporation meter . | 79,300 | | |
| Fuel used from Dec. 9 to Dec. 16: Coke | £ | s. | d. |
| dust—41 tons 4 cwt., at 1s. 11d. . | 3 | 19 | 0 |
| Washed slack—15 tons 17 cwt., at 6s. 6d. | 5 | 3 | 2 |
| | £9 | 2 | 2 |

This works out at a fraction under 2s. 4d. per 1000 gallons. Can this result be beaten? I may add that the water-feed to the boilers is heated by the exhaust steam from the engines to 200 deg.

Yours truly,
C. D. LENG.

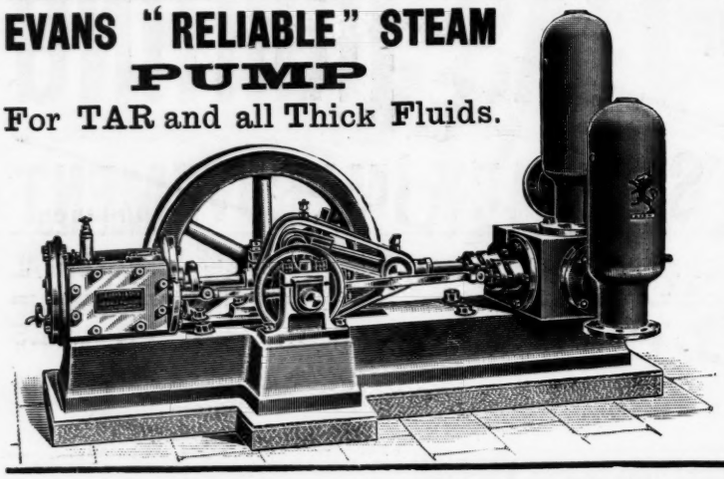
High Street, Sheffield, Dec. 19, 1904.

FOR FURTHER PARTICULARS APPLY—

**MELDRUM BROS., LTD.,** TIMPERLEY, MANCHESTER; AND 66, VICTORIA STREET, WESTMINSTER.

## EVANS "RELIABLE" STEAM PUMP

For TAR and all Thick Fluids.



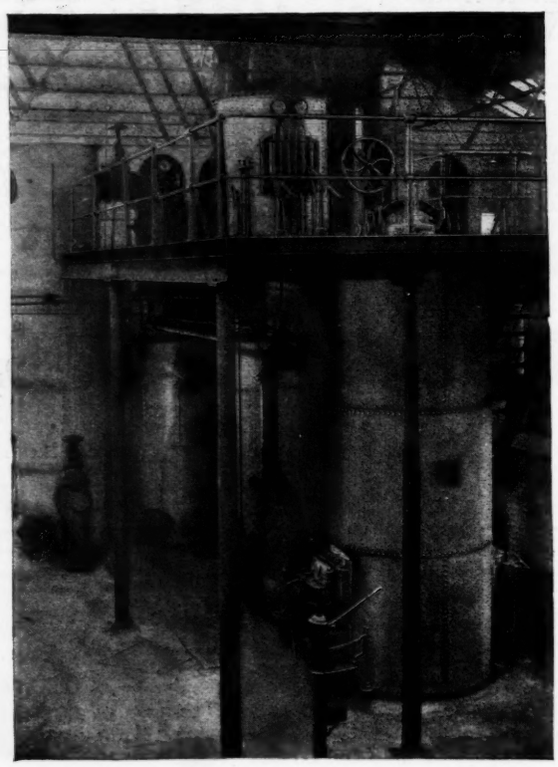
## FIRST AWARDS EVERYWHERE.

*Write for No. 8 Catalogue.*

Telegrams:
"EVANS, WOLVERHAMPTON."
National Telephone No. 39.
**London Office,**
SALISBURY HOUSE, LONDON WALL, E.C.

## JOSEPH EVANS & SONS,
CULWELL WORKS,
WOLVERHAMPTON.

# W. C. HOLMES & CO.



GENERATING ROOM. Carburetted Water-Gas Plant.
Capacity 200,000 Cubic Feet per Day.

MAKERS OF

## CARBURETTED WATER-GAS PLANTS.

"Holmes" Rotary Scrubber-Washer.

PELOUZE & AUDOUIN TAR-EXTRACTORS.

## DOUBLE-FACED VALVES.

HORIZONTAL OR VERTICAL FORM.

COMPLETE COAL-GAS INSTALLATIONS.

## Works: HUDDERSFIELD.

*London Office: 11, VICTORIA STREET, S.W.*

*HIGHEST AWARDS—LONDON, PARIS, COLOGNE, VIENNA, MELBOURNE, AND OTHERS.*

## —11 MEDALS.—

MANUFACTURERS OF TUBES AND FITTINGS OF EVERY DESCRIPTION.

## WROUGHT-IRON OR STEEL MAINS UP TO 6 FEET DIAMETER FOR GAS, WATER, OIL, OR OTHER PURPOSES

SCREWING TACKLE, BOILER MOUNTINGS, VALVES, COCKS, ETC.

| LONDON: | MANCHESTER: | BIRMINGHAM: | LEEDS: |
|---|---|---|---|
| 108, Southwark Street. | 33, King Street West. | 114, Colmore Row. | 6, Mark Lane, New Briggate. |

Every Description of
FIRE-CLAY GOODS
OF BEST QUALITY ONLY.

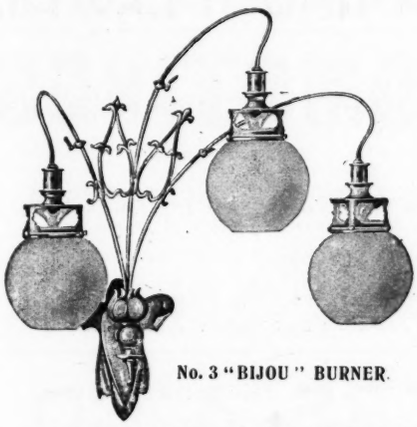
Personal attention given to all orders.

MOBBERLEY & PERRY,
STOURBRIDGE.

INCLINED
AND HORIZONTAL
RETORTS of both Taper and Parallel Sections.
SPECIALS FOR WATER GAS PLANTS
CHECKER BRICKS ALWAYS IN STOCK
LARGE STOCKS KEPT.

THE
ORIGINAL NEW INVERTED BURNERS.

The "BIJOU" BURNER is the neatest, most decorative, and economical ever known, and is the real rival to Electric Light at One-Tenth the cost.



No. 3 "BIJOU" BURNER.

All Mantles we supply are made of best double-woven Ramie, and marked with our Trade Mark,

"NICO."

No. 2 BURNER.

INVERTED FITTINGS OF EVERY DESCRIPTION AND UP-TO-DATE DESIGNS.

The New Inverted Incandescent Gas Lamp Co., Ld.
23, FARRINGDON AVENUE, LONDON, E.C.

# IMPORTANT NOTICE.

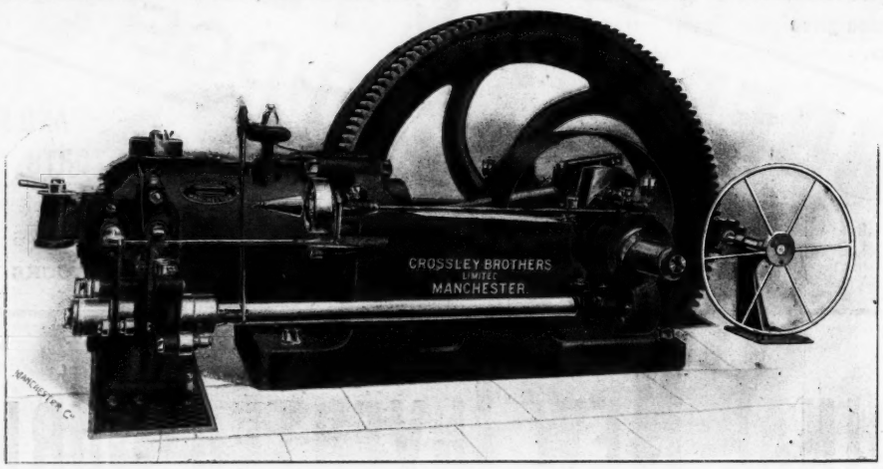
It is the practice of the "Gas World" to publish from time to time analyses of the accounts of Gas Undertakings in this Country. A number of such analyses appeared in the issue for September 16, and they show that at Fenton, Longton, Rotherham, and Tipton, some of the highest results were obtained in Gas Made and Coke Sold.

It may be interesting to Gas Engineers to learn that at these four places Winstanley's Settings are in use.

The Winstanley Speciality Company, Newton Chambers, Cannon Street, Birmingham.

# CROSSLEY'S GAS-ENGINES

**SUITABLE FOR DRIVING EXHAUSTERS, PUMPS, &c.**



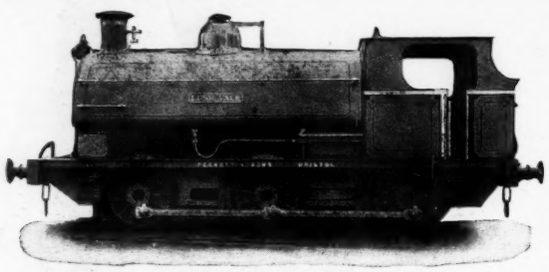

Represents XAE Type High-Speed Electric Light Engine giving 75 Effective Horse Power.

Up to the end of 1904, over 51,000 Gas and Oil Engines have been delivered, representing about three-quarters of a million actual horse power.

IMMEDIATE DELIVERY FOR STOCK SIZES OF ENGINES.

**Large Number of Second-Hand Engines always in Stock.**

## CROSSLEY BROS., LTD., OPENSHAW, MANCHESTER.



# LOCOMOTIVES

LOCOMOTIVES of all Sizes and Gauges specially constructed for Main and Branch Lines, Contractors, Docks, Gas-Works, Collieries, Iron-Works, Brick and Cement Works, &c. Locomotives of various Sizes always in Stock, ready for immediate delivery.

**Photographs, Specifications, and Prices on Application.**

## PECKETT & SONS, Atlas Locomotive Works, BRISTOL.

**Telegraphic Address: "PECKETT, BRISTOL."**

# NEWTON, CHAMBERS, & CO.,

LIMITED.

**THORNCLIFFE IRON-WORKS, near SHEFFIELD.**

**Established 1790**

LONDON OFFICE: **19, Great George Street, WESTMINSTER.**

**Telegraphic Addresses, "NEWTON, SHEFFIELD," "ACCOLADE, LONDON."**

## GAS ENGINEERS, IRONFOUNDERS, and CONTRACTORS.

*MANUFACTURERS OF EVERY DESCRIPTION OF*

PLANT, APPARATUS, AND MACHINERY FOR GAS AND CHEMICAL WORKS.
RETORTS AND FITTINGS, MOUTHPIECES WITH SELF-SEALING LIDS.
IMPROVED COAL AND COKE HANDLING PLANT, CONVEYORS, AND ELEVATORS.
CONDENSERS, SCRUBBERS, AND WASHERS.

**PURIFIERS with Planed Joints a Speciality.**

PATENT CENTRE-VALVES, RACK AND SCREW VALVES, WOOD GRIDS AND SCRUBBER-BOARDS, CAST-IRON MAINS, AND SPECIALS.
STRUCTURAL WORK, COLUMNS, GIRDERS, AND ROOFING.
GASHOLDERS, CAST-IRON OR STEEL TANKS.

*DESIGNS, SPECIFICATIONS, and ESTIMATES FREE.*

**PIG IRON (SPECIAL QUALITY) for Engine Cylinders. GAS COAL famous for its Unrivalled excellence.**

# WELSBACH LIGHT

**(PATENTED)**

Fig. 35. 100 c.p.

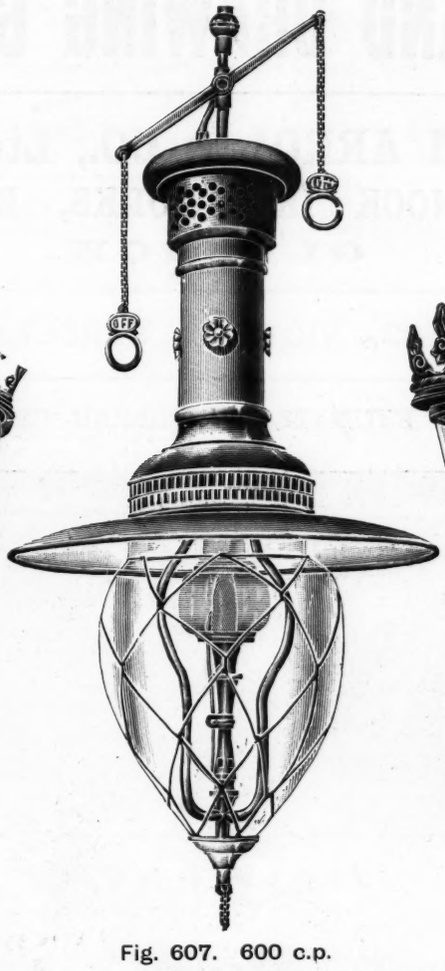



Fig. 607. 600 c.p.
Self-Intensifying.

Fig. 35a. 300 c.p.
Self-Intensifying.

## WELSBACH "C," "CX," AND PLAISSETTY MANTLES,

**4½d. each, subject.**

**Thousands of the above Lamps in use and giving satisfaction.**

**EACH LAMP AND MANTLE GUARANTEED.**

**THE**

# WELSBACH INCANDESCENT GASLIGHT CO.

LIMITED

**2 to 14, Palmer Street, WESTMINSTER, S.W.**

*Telegrams: "WELSBACH, LONDON."* *Telephone: 290 WEST.*

# ARROL-FOULIS

## PATENT HYDRAULIC MACHINERY

FOR

## CHARGING AND DRAWING GAS-RETORTS

**SIR WILLIAM ARROL & CO., Ltd., Sole Makers,**
**DALMARNOCK IRON-WORKS, BRIDGETON,**
**GLASGOW.**

LONDON ADDRESS: 32, VICTORIA STREET, WESTMINSTER, S.W.

PLANS AND ESTIMATES FURNISHED ON APPLICATION.

THE **ARROL-FOULIS** MACHINES Are Employed at the following Works—

GLASGOW GAS-WORKS—
Tradeston.
Dawsholm.
Dalmarnock.

GASLIGHT & COKE COMPANY—
Beckton.
Shoreditch.
Bromley.

SOUTH METROPOLITAN GAS COMPANY—
East Greenwich
Vauxhall.
Rotherhithe.

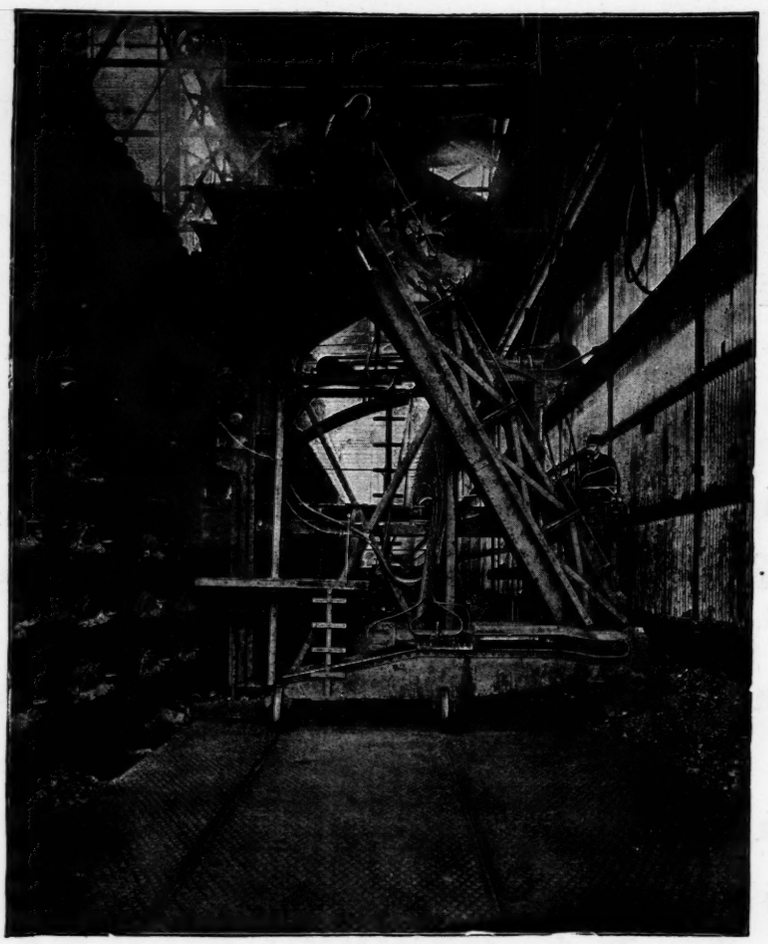
COMMERCIAL GAS-WORKS—
Wapping.
Poplar.

BROMLEY GAS-WORKS (KENT).

EDINBURGH GAS-WORKS.

LIVERPOOL GAS-WORKS.

BRIGHTON GAS-WORKS.



ROTHERHITHE GAS-WORKS.

THE **ARROL-FOULIS** MACHINES Are Employed at the following Works—

LEEDS GAS-WORKS.

BIRMINGHAM GAS-WORKS.

BRITISH GAS CO.—
Hull.

BOLTON GAS-WORKS.

IMPERIAL CONTINENTAL GAS ASSOCIATION—
Amsterdam.
Vienna.
Berlin.

HAGUE CORPORATION GAS-WORKS—
Hague.

METROPOLITAN GAS-WORKS—
Melbourne.

CLEVELAND GAS-WORKS—
Cleveland, Ohio,
&c., &c., &c.

NEARLY 300 MACHINES ARE AT WORK OR IN COURSE OF CONSTRUCTION.

THE TIME TAKEN TO DRAW AND CHARGE EACH RETORT BY THESE MACHINES AVERAGES

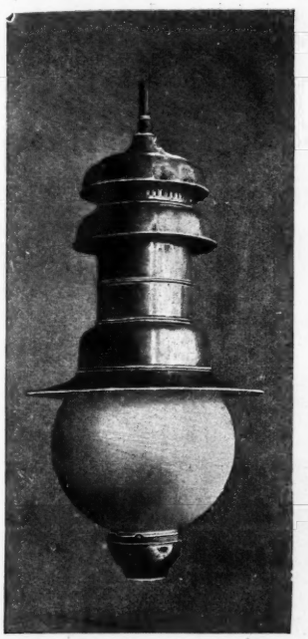
# UNDER ONE MINUTE.

# THE 'KHOMA' INCANDESCENT GAS-LAMP

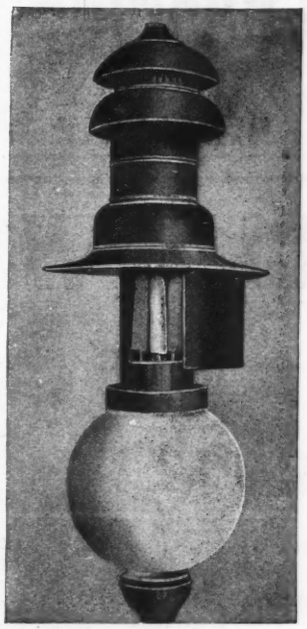
## FOR EXTERIOR LIGHTING.

*Patent No. 9747, 1904.*

Lamp with Globe up ready for use.



Globe lowered, showing wind-proof shield with door open for access to Mantles. Bottom cup can be removed for Globe cleaning.



**The Solution of the Problem of Outside Lighting by Incandescent Gas.**

SPECIALLY RECOMMENDED TO GAS COMPANIES MAINTAINING LAMPS.

**English Manufacture.**

**4 MANTLES—500-CANDLE POWER.**

**Solid Copper throughout, except Reflector, which is Enamelled Iron.**

A Gas Lamp to be efficient must be maintained in perfect order, and the Globe and Chimneys kept clean. When Chimneys are used to protect Mantles they quickly become dirty, thus obscuring the light. The breakage of Chimneys also destroys a large percentage of Mantles. The "Khoma" exterior lamp eliminates the necessity of Chimneys, and enables one to clean the Globe or replace a Mantle without subjecting the other Mantles to the breeze.

## KHOMA GAS ARC LAMP, LTD.

*Office and Works:*

**96, MIDDLESEX STREET, LONDON, E.**

---

# SAML. CUTLER & SONS,

MILLWALL, LONDON.

**GASHOLDERS.**

**STEEL TANKS.**

**CONDENSERS.**

**ROOFS.**

•

**JÄGER GRIDS**

CAPACITY OF PURIFIERS DOUBLED.
PRESSURE CONSIDERABLY REDUCED.

•

**Special Circular describing the Jäger System of Purification on application.**

## CARBURETTED WATER GAS

**Maximum Efficiency Guaranteed.**

A LARGE NUMBER OF PLANTS IN OPERATION.

**Every Requirement for Gas-Works.**

(198.)

# THOUSANDS SURPRISED

AT THE EFFICIENCY OF THE

## "OMEGA"

**ODOURLESS GAS HEATER** (Without Flue)

HYGIENIC & RELIABLE.
NO RISK OF FIRE.

TESTED FOR SIX YEARS.

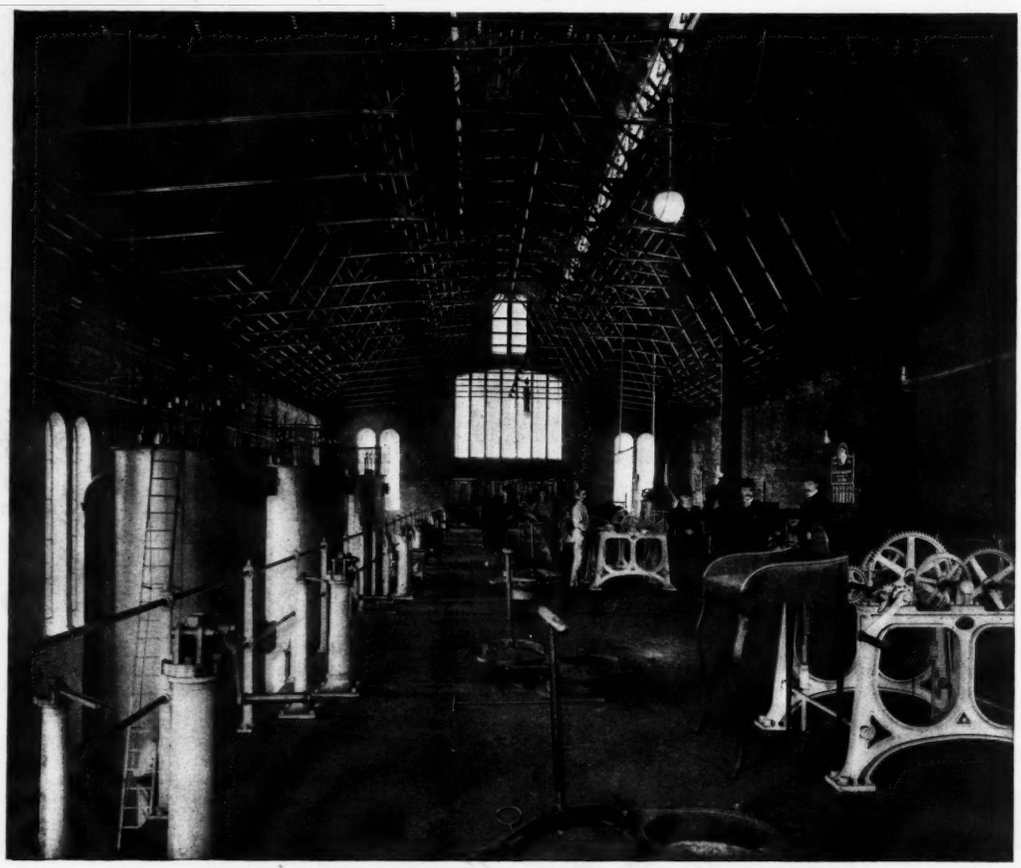
**Price 15/- to £6. Only the Trade supplied.**

[Just the Heater for Gas Companies to hire out].

THE OMEGA ODOURLESS GAS STOVE CO., LTD.,
WILDER STREET, BRISTOL.

# BLUE WATER GAS APPARATUS

(DR. KRAMERS & AARTS PATENTS).



The Kramers and Aarts Water Gas Plant at Amsterdam. Operating Floor.

## Guaranteed Results per 1000 Cubic Feet of Gas.

**Calorific Power, 315 B.T.U. per cubic foot.**

**Use of Carbon in the Generators, 22 lbs.**

**Use of Steam in the Generators, 3·3 Gallons.**

| Percentage Composition | |
|---|---|
| $CO_2$ | 3·5 |
| $O_2$ | 0·2 |
| CO | 45·0 |
| H | 48·0 |
| Difference | 3·3 |

Plants erected since 1902, or in erection, at the following Gas-Works—

| | Cubic Feet Daily. |
|---|---|
| Amsterdam | 2,118,000 |
| Zevenbergen | 125,000 |
| Breda (Test Station) | 425,000 |
| Cadiz | 125,000 |
| Venlo | 175,000 |

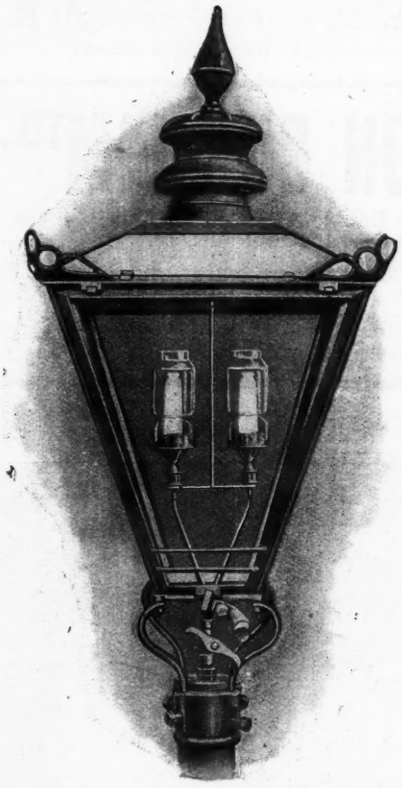
**Offices: P.C. HOOFTSTRAAT 62, AMSTERDAM.**

# BRAY'S "BAGBY" LANTERNS

**For Incandescent Street Lighting.**

**ALL COPPER.**

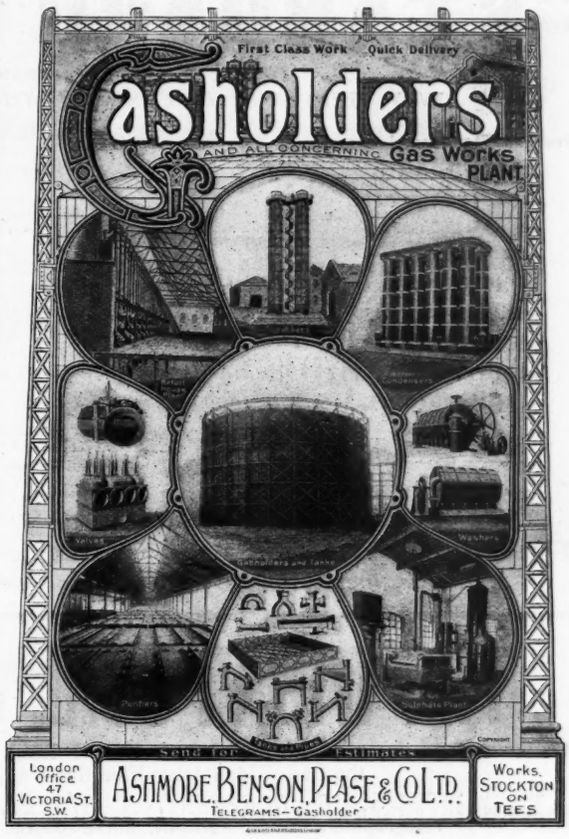
**WIND AND RAIN PROOF.**



BRAY'S No. 2 "BAGBY" LANTERN,
FITTED WITH
*Enamelled Earthenware Reflector,*
*"Bray" Burners and*
*Anti-Vibrating Frame.*

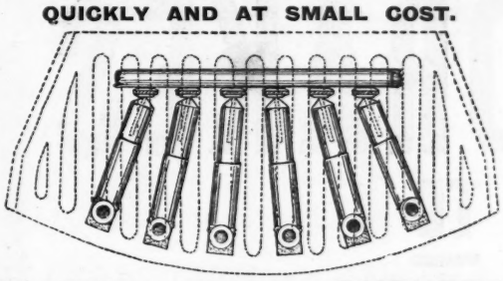
These Lanterns are in use in large numbers for Street Lighting in many of the principal Cities in the United Kingdom.

**GEO. BRAY & CO., LTD.,**
GAS LIGHTING ENGINEERS,
**LEEDS.**


First Class Work Quick Delivery
Gasholders
AND ALL CONCERNING Gas Works PLANT
Send for Estimates
London Office 47 VICTORIA ST. S.W.
ASHMORE, BENSON, PEASE & CO. LTD.
TELEGRAMS—"Gasholder"
Works. STOCKTON ON TEES

# FIT GAS-FIRES TO COAL GRATES

**QUICKLY AND AT SMALL COST.**



**TILLEY'S (PATENTED) BURNERS**
**Can be Adjusted to Shape of Grate and Gas Pressure *in situ*.**

**TILLEY BROS.,**
53, KINGSLAND ROAD, LONDON, N.E.

*Patent applied for. Registered.*

**GREAT NOVELTY**

THE
**ROYAL INCANDESCENT GAS-LIGHT CANDLE.**

**The most decorative Gas-Light ever offered.**

**A perfect combustion Burner.**

**Cannot get out of order.**

**60-Candle Power with 2½ cubic feet of Gas.**

**Can be used anywhere instead of a "C" Burner.**

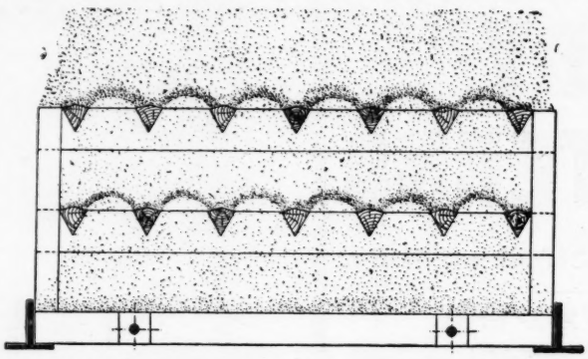
Address of your nearest Wholesale Factor will be sent on application to No. 4374, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

# "STANDARD" PURIFYING GRIDS.

(F. D. MARSHALL'S PATENT.)

*THE ONLY GRID WHICH ENSURES THE FORMATION OF SUPPORTING ARCHES.*

**Orders Received from—**
**ABERCARN,**
**ABERYSTWYTH,**
**ARMAGH,**
**BARNET,**
**BECKTON,**
**BIRMINGHAM,**
**CHICHESTER,**
**HAMPTON COURT,**
**HOLMFIRTH,**
**ILFORD,**
**LEA BRIDGE,**



**Orders Received from—**
**LEYLAND,**
**LIVERPOOL,**
**LONDONDERRY,**
**PORT ELIZABETH,**
**POYNTON COLLIERIES,**
**REDHILL,**
**RICHMOND,**
**ST. IVES,**
**TICEHURST,**
**WORTHING.**

## KIRKHAM, HULETT, & CHANDLER, LIMITED,

**Palace Chambers, Bridge Street, Westminster, S.W.**

**Sole Agents for the Berlin-Anhaltische-Maschinenbau Act. Ges. Specialities.**

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# THE WIGAN COAL & IRON CO., LIMTD.,

**Are exclusive Owners of the well-known HAIGH HALL & KIRKLESS HALL GAS COAL COLLIERIES, and supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, Cannel Nuts, &c.**

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Telegraphic Address: "WIGAN, BIRMINGHAM." Telephone No. 200.

LONDON DISTRICT OFFICE: *6, STRAND, LONDON—C. PARKER & SON, Sole Agents.*
Telegraphic Address: "Parker, London."

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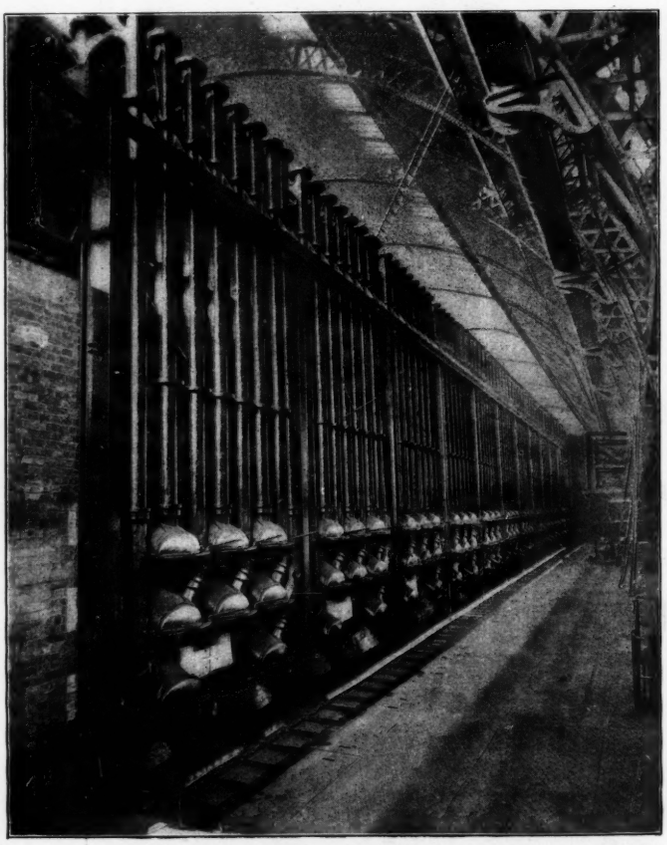
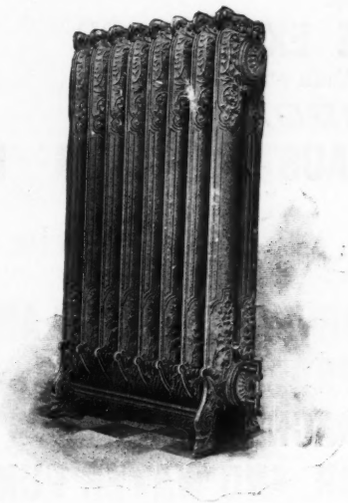
# DRAKES LTD. HALIFAX.

LONDON OFFICE:
181, QUEEN VICTORIA ST., E.C.

MELBOURNE:
31, QUEEN STREET.

## Inclined Retort Installation, With Hot-Coke Conveying Plant.





The "MARS"
Gas-heated
Steam Radiator.

(Under License from John Wright & Co.).

Made properly . . .
Acts automatically.
Radiates admirably
Sells readily. . . . .

ARDEN HILL & CO.,
"ACME" WORKS,
ASTON, BIRMINGHAM.

# COAL TAR PRODUCTS.

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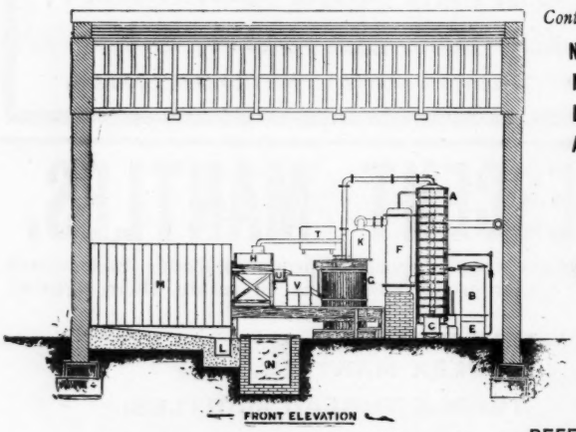


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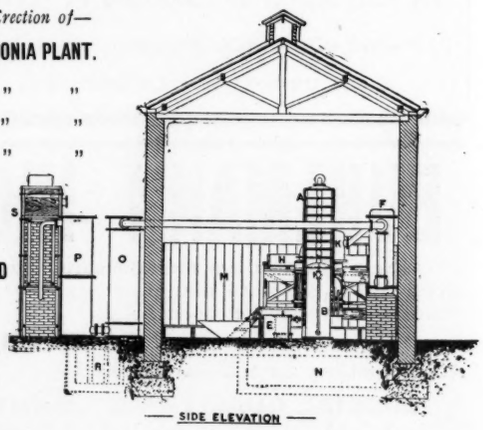


SIDE ELEVATION

REFERENCES.

*A.* Large Still (Ammonia).
*B.* Small Still (Lime).
*C.* Spent Liquor Valve.
*E.* Limeing Arrangement.
*F.* Heater.
*G.* Saturator.
*H.* Draining Table.
*K.* Lead Catch Box.
*L.* Mother Liquor Well.
*M.* Sulphate Store.
*N.* Acid Store Tank.
*O.* Condenser.
*P.* Scrubber.
*R.* Settling Tank.
*S.* Neutralization Plant.
*T.* Acid Supply Tank.
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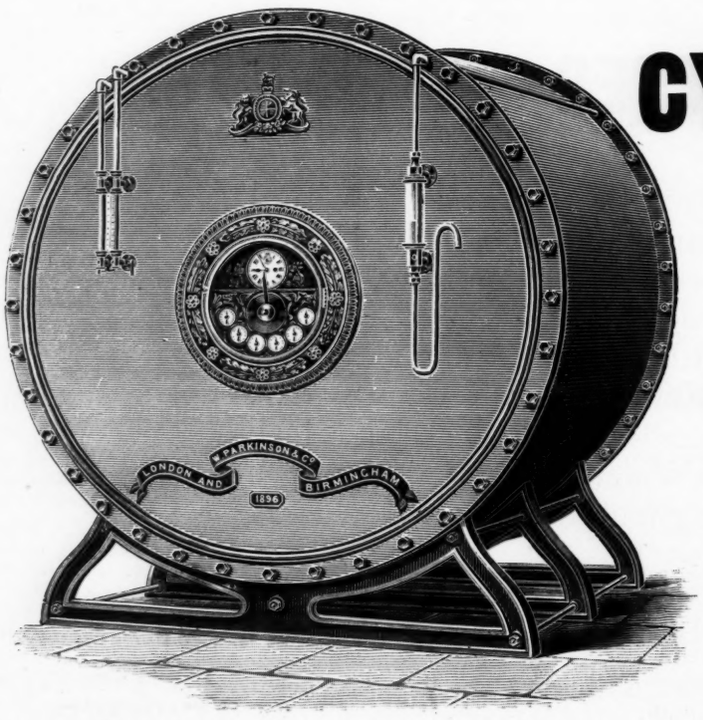


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VOL. XCII., No. 2221.—TUESDAY, DECEMBER 5, 1905.


## EDITORIAL NOTES—GAS, &c.

### The New Testing-Burner for London Gas—Bill Promotions Affecting Illuminating Power.

WE have great satisfaction in being able to announce that the Gas Referees have decided to accept, under the provisions of the London Gas Act of last session, the burner submitted to them by the three London Companies for testing the illuminating power of the gas supplied by the latter. An illustration of the burner we are also enabled to give, through the courtesy of Mr. Charles Carpenter, the Engineer-in-Chief of the South Metropolitan Gas Company. This is the *finale* of a somewhat long contest on the subject of gas testing between the London County Council and the Gas Companies, the issue of which was at one time in considerable doubt, but which, thanks to the pertinacity of the latter, ended satisfactorily, and indeed triumphantly, for the gas industry.

It will be recollected that the South Metropolitan Gas Act, 1900, under the provisions of which the gas supplied by that Company was reduced to 14 candles, prescribed that the gas should be tested when consumed at a rate to give an illuminating power of 16 candles; thus following the instructions of the Gas Referees with regard to testing 16-candle gas, and so as to avoid the depreciating effect of the "London" argand when gas of lower quality than 16 candles is consumed at the rate of 5 cubic feet per hour. This provision passed without challenge from the London County Council, who, however, two years afterwards very strongly opposed a similar provision applied for by the Commercial Gas Company when they also sought for authority to reduce their illuminating power to 14 candles—it being stated that its unopposed passage in the case of the South Metropolitan Company was the result of an oversight. Their proposal that the method employed for testing should be left to the Gas Referees was—in a weak moment, as it was then regarded, but, as it has turned out, in a fortunate one for the Companies—agreed to by the Commercial Company. To the surprise of most people, the Gas Referees found that they had no power to prescribe, for testing this Company's gas, anything else than the 5 cubic feet rate of consumption method; and thus an anomalous and most unsatisfactory position was created—the gas supplied by the two Companies, although of practically the same value, being rated as though there was fully a candle difference between them. To remedy this injustice, the Commercial Company promptly gave notice of an application to Parliament for the South Metropolitan clause; while the London County Council, whose cupidity was aroused, saw in the incident an opportunity for establishing the 5 cubic feet rate of consumption method for testing the gas of the South Metropolitan Company as well, and of wresting from both Companies a higher illuminating power by one candle than had been arranged for in their respective Acts of Parliament. They accordingly promoted a Bill of their own for this object; and this may be regarded as their first step in the —to them—slippery path of legislation on the subject of gas testing.

It is an interesting reflection that had this Bill not been launched, the Gas Companies might to this day have been as far off as ever from any emancipation from the yoke of sulphur restrictions, because then there would have been no Departmental Committee. The question before Parliament would have been merely that of whether or not the Commercial Company were entitled to the South Metropolitan clause; and this would have been fought out on their Bill. As it was, the London County Council soon began to think that the subject of gas testing was too technical for a Parliamentary Committee; and a proposal was made to the Companies for a reference of the subject of the two Bills to a Departmental Committee. This was ultimately agreed to; but the scope of the inquiry was extended so as to include the whole question of testing for purity, as well as for illuminating power, quality of gas supply, and other matters. The Commercial Company's Bill was amended so as to provide for a continuance for three years of the existing method of testing; the Bill promoted by the London County Council being withdrawn. The work of the Committee, although in other respects highly satisfactory, was as regards the present subject very disappointing; for they recommended in their report a reversion to the 5 cubic feet rate of consumption method for testing the 14-candle gas supplied by the South Metropolitan and Commercial Companies, and that this gas should henceforth be known as 13-candle gas. Although this may appear at first sight to be only an alteration of nomenclature without any attendant practical disadvantage, it was felt that it involved a grave injustice to the supply of these two Companies, and much dissatisfaction was at once expressed with this decision of the Departmental Committee. This found vent almost immediately in the resolution expressing dissent therefrom which was passed unanimously at the meeting of the Institution of Gas Engineers in 1904; this being followed up later by a memorial to the Board of Trade. In this memorial, it was suggested that, in lieu of the 5 cubic feet rate of consumption method, the gas under test should in all cases be consumed at such a rate as would give a height of flame of $3\frac{1}{2}$ inches, and the result obtained corrected to a 5 feet rate of consumption by direct proportion as at present. This method would at that time, and later, have been accepted, by the Gas Companies immediately concerned, as a settlement of the question; and it is also believed that it would have been satisfactory to the gas industry generally as applicable to all qualities of common gas. No action was taken by the Board of Trade on this memorial; and the interview asked for by the Council of the Institution of Gas Engineers was refused.

The matter came up for consideration first in the Commons, the Committee of which declared themselves bound by the recommendation of the Departmental Committee. In the meantime, however, evidence had been accumulating which showed the utter untrustworthiness of the 5 cubic feet rate of consumption for lower qualities of gas than 16 candles when tested with the "London" argand; and when the London Gas Bill came before the Committee of the House of Lords, the Companies were able to show conclusively the hardship that must result from the adoption of the method proposed by the Bill. The memorable decision of the Earl of Rosse's Committee, that the test which was prescribed by the Bill was not a satisfactory one, was extremely galling to the London County Council, inasmuch as the retention of the 5 cubic feet rate of consumption method was the one remaining plank that had been left for them to stand on—practically all else in the Bill having gone by the board. They thereupon threatened to withdraw the Bill; but eventually an adjournment was arranged —the Companies feeling that an attempt at a compromise should be made rather than that the Bill should be at once lost. During the adjournment, an agreement was arrived at, by which the 5 cubic feet rate of consumption method was retained; but the Gas Referees were to prescribe the burner and chimney (if any), which must be of such a pattern—not being an incandescent or similar burner—as shall be practicable for use by the consumer, and shall be the most suitable for obtaining, and in making the test shall be so used as to obtain, from the gas, when consumed at the rate of 5 cubic feet per hour, the greatest amount of light. In pursuance of this duty, the Gas Referees have had under consideration various burners that have been submitted to them, with the result stated above.

The new burner (which will be known as the "Metropolitan Argand Burner No. 2") has been devised by Mr. Charles Carpenter, and is, in effect, what has hitherto been known as the "Wandsworth," but with an adjustable air supply, which renders it suitable for the testing of all qualities of "common" gas, whether made entirely from coal or

from a mixture of coal and carburetted water gas. That the burner will give a better result than the now discarded "London" argand, is a foregone conclusion, since the all-important condition for the development of illuminating power by this class of burner is the proper regulation of the air supply, which is secured to a nicety by Mr. Carpenter's ingenious arrangement. That the decision of the Gas Referees will be regarded as satisfactory by the London County Council or their advisers, is more than we would venture to say; but they have made their bed, and must lie upon it. They have been told over and over again that satisfactory testing can only be secured by observing one or other of two conditions: Either the rate of consumption must be varied, or the air supply properly regulated. They would not have the former; they must now have the latter.

The announcement now made is of the greatest importance to those Companies who have given notice of their intention to apply for authority to alter their illuminating power and testing provisions, and who now, therefore, have to draft their testing clauses. It is most important that at this juncture no mistakes should be made, since by adopting the new burner the much-desired uniformity of testing method may be secured. This cannot be too strongly urged upon all who are thus immediately concerned. Let it be most clearly understood that regulation of the air supply is practically the same thing as burning the gas at a fixed height of flame, and it will be seen that the new burner deals equal justice to all qualities of common gas, and consequently secures uniformity of testing. It is greatly to be desired, therefore, that this should be specified as the testing-burner in all the Bills for the coming session in which it is proposed to deal with the subject of gas testing.

## High-Pressure Gas Distribution.

Following close upon the very interesting paper by Mr. R. Herring, on a high-speed exhauster for pressure-raising, which was read at the recent meeting of the Southern District Association of Gas Managers, we are enabled to publish in this issue the first portion of a paper entitled "High-Pressure Gas Distribution of To-Day," read at the meeting, in October last, of the American Gaslight Association, by Mr. H. L. Rice, of Aurora (Ill.), which will be found well worthy of careful attention. Though the first example of gas distribution at high pressure was afforded years ago by the Gaslight and Coke Company, in the conveyance of gas from their Beckton works to London, yet America may be regarded as having been the home of the system ever since the discovery there of natural gas, the utilization of which necessitated its conveyance to great distances from its sources. This, however, not being illuminating gas, was not likely to become depreciated in quality by being subjected to compression; and the difficulty which was for many years experienced in making the joints of the pipe-lines sound under the heavy pressures employed, precluded all idea of the utilization of this system for the distribution of illuminating gas. Indeed, so abundant was the supply for some years that there appeared to be little inducement to practise economy by the prevention of waste; and the spectacle was afforded to the traveller, on nearing Pittsburg, for example, of columns of flame rising in the air every one or two hundred yards, by which he was enabled to trace the course of the pipe-line which supplied the city with this product. Presumably, it paid better to let the escaping gas burn away than "mess" with the joints. In course of time, however, natural gas became less abundant, and ingennity was successfully taxed to prevent its waste.

Then came the time of the illuminating gas purveyors, who were not slow in following suit, when once the practicability of distributing gas at high pressure without waste was established. The result, as seen from this paper, is that high-pressure distribution has become an established practice in America, where, it must be admitted, the circumstances are much more favourable to its general adoption than they are in this country. Here, almost every township of any size has its own gas-works; and new townships are of very rare occurrence. In America, on the other hand, there is still a vast area of country in course of development; and, as townships spring up, the opportunity occurs for supplying them with gas from a central source. Still, there is in this country a field—albeit somewhat limited—for similar applications of the high-pressure system; and it may be expected that, wherever opportunity offers for its development, enterprise in this direction will not be wanting. Already, in addition to the employment of high pressure for filling gasholders at a distance, or for reinforcing low-lying or distant districts, there is at least one example in this country of distribution proper at high pressure—namely, that which has been furnished at Nuneaton by Mr. George Helps. Here, by a high-pressure main 5 miles in length, gas is distributed at a pressure of 9 lbs.; this being reduced by separate house regulators to pressures varying from 3 to 20 inches.

A remarkable development of this system is stated in the paper to be taking place in the neighbourhood of Chicago, where the Western United Gas and Electric Company are supplying no fewer than twenty-four cities and towns, with a combined population of 140,000, and an extreme distance of 52 miles between centres. What, it might well be asked, with such an example in view, can there be to prevent the economical distribution of gas from some river-side or other works, where the cost of manufacture is low, in substitution for works less favourably situated? One answer that may be given is, that "scrapping" is not the favourite pastime here that it is supposed to be in America; and "scrapping" on a rather extensive scale might have to be the result of a huge system of high-pressure distribution (say) either on the north or on the south side of the Thames. A further answer would be, that huge combinations such as this would indicate are not very much in favour in this country at the present time. Above and beyond these several considerations, however, there is the doubt, which the paper leaves unsolved, as to the economical advantages of the system under ordinary conditions of the distribution of gas. We do not, of course, refer to its use as applied to reinforcing pressure or filling gasholders at a distance. But given a number of separate districts, under what circumstances will it pay better to supply from one central source by means of high pressure than to establish separate works? This is a question which can only be decided by a careful comparison based upon the further particular circumstances of the districts in question. It can certainly not be decided satisfactorily by reference to vague and general principles.

On one other matter, however, the paper does throw considerable light—namely, upon the quantity of gas delivered under certain pressures at the end of pipes of varying lengths and diameters. In this respect, it is an extremely useful supplement to the paper which was read at the meeting of the Institution of Gas Engineers last year by Professor W. C. Unwin, and greatly adds to the general stock of information on this point. Strange to say, however, there is, notwithstanding the numerous applications of the high-pressure system (a list of which is given in the appendix to the paper, which will be published by us later), a paucity of information as to the effect of compression on illuminating power. It is only known that, as stated by the author of the paper, "the gas so far delivered under pressure has been uniformly satisfactory." This, however, might not be found to meet the somewhat exacting conditions under which so many gas undertakings in this country have to carry on their business; but the point becomes of less importance with the reduction of the standard of illuminating power, since low-grade gas is certain to suffer (if at all) less from compression than gas of a comparatively high illuminating power. It is the financial aspects presented by the system that are most in need of investigation.

## Work and the Workless.

The week has passed, and not a single communication has reached us regarding Mr. Henry Woodall's letter in the last issue of the "Journal," under the heading of "Distress and the Children." Does this mean that the fountains of charity are dry in the gas industry, or that the scheme advanced by Mr. Woodall does not commend itself? We confess to being at a loss for an answer; but it is devoutly hoped the former is not the case. As was remarked in an article in the fore part of last winter, the gas industry has much to be thankful for in that the season of the year most productive of distress is the one when the maximum of labour is required in gas making and its distribution. "Then," as was admirably expressed by Mr. Woodall in his letter, "the greater the reasonableness of a thank-offering." These are words not only for thought, but words that should inspire action. The distress of the day confronts us in the streets of all great cities; but among the provident workers of the gas industry, comfort, in the worst days of the year, is found. For this we all rejoice, and should remember it when well-directed effort appeals to us.

It is also a matter for thankfulness that, in trades which touch closely upon the gas industry, there has latterly been an improvement in the demand for labour. According to the returns which reached the Board of Trade for October, employment in that month was better than in September. The pig iron, iron and steel, and tinplate trades were all brisk; and there was a general enhancement of the conditions in the engineering and shipbuilding trades. It is also reported that the coal-mining industry showed an improvement apart from the seasonal change at this time of the year. But this story does not apply to several other labour occupations that come within the cognizance of the Board, nor in those innumerable other classes of employment that are not and cannot be the subject of report. It is true the Unemployed Workmen Act of 1905 has been put into operation; but it is equally clear that this Act alone will not universally alleviate the existing destitution. Hence the initiation, and success, of effort of kindly-disposed persons on the methods that experience of the past has suggested as the wisest, and the ones that reach the most deserving. Excepting in respect of the aged, infirm, and sick, one now hesitates to recommend—so great has been the abuse of charity—any scheme that (other than in the case of the children) does not embrace the returning of a certain amount of work for a given amount of pay.

It is quite clear, too, that our Poor Laws, efficient as they may have been at one time of day, are not so now; and therefore there must be general gratification that the King has been pleased to ratify the promise made by Mr. Balfour, at the time (after much disheartening attempt) he prevailed upon the House of Commons to pass the Unemployed Bill, that there should be a Royal Commission to inquire into the Poor Laws. The Act, with all its shortcomings, is the centre of much of the excellent work that is now being done. It can, however, only be regarded as a temporary expedient. The Commission has been appointed; and the great scope of their investigation is comprised in few lines. They are to inquire into the working of the laws relating to the relief of poor persons in the United Kingdom, and into the various means that have been adopted outside the Poor Laws, for meeting distress arising from want of employment, particularly during periods of severe industrial depression. It is a wide reference, but from the composition of the Commission, we look for much eventual good. Almost simultaneously with the notification of the constitution of this Commission, the Secretary of State for War has appointed a Committee to inquire into the question of the provision of civil employment for ex-soldiers; and the gas industry will count it an honour that the Committee includes the name of Sir George Livesey. For this, if for no other reason, the inquiry will bespeak the interest of the gas industry. The poor and labour are not by any means being neglected in these days—their affairs, in fact, comprise the most prominent domestic question of the hour.

## The "Progress" of a Progressive Borough.

Prefaced by the two articles by Lord Avebury which were noticed last week, the "Standard" has commenced an exposure of the weak and dark places in the work and management of the Metropolitan Borough Councils, with the result that there has been no little commotion in municipal circles; for this examination is stirring up open resentment against the extravagance of the local bodies from ratepayers whose previous remonstrances have been of a more private and apathetic nature. Publicity is not what the local authorities want, as the spread of discontent will mean a growth of opposition; and the stronger the immediate opposition, the sooner will those who are responsible for costly inefficiency be knocked from the pinnacles to which personal glorification chiefly has caused them to climb. The articles in our morning contemporary prove, *inter alia*, that the extravagance is general—that the Councils containing a preponderance of the "Progressive" and Socialistic elements are little worse, judged by total figures, than some of those in which they do not flourish so largely. But there is this difference, that where the rates are appreciably higher than in other districts, there those elements to which reference is made are found to have the majority vote in the local administration; and what is more, it is in those districts where the poor abound and poverty is rife (where the voice of the Progressive and the Socialist claims the ear) that the old adage as to cutting one's coat according to one's cloth finds little sympathy or practice.

Battersea is taken as an example; and there the charges of prodigality make lugubrious reading. The County Council on their part have been responsible for a not insignificant share of the increase in the rates; their action, combined with that of the local administration, has, between 1888-9 and 1904-5, sent the rates flying up from 5s. 3d. in the pound to 8s. 2d., and the assessments have been tailing behind, so as to mitigate the ugliness of the local financial requirements. The Borough Councillors blame the County Council; and the County Council reply by pointing to the alarming growth of the loan-debt of the respective boroughs. There has been a good deal of remark lately about "beams" and "motes" in the discussion of this subject; but as beams and motes in this connection appear to have an equality in the matter of size, it would be well to leave them alone. Look at the Battersea illustration. The population between 1888-9 and 1904-5 has only grown by about 30,000; but the rateable value has expanded from £661,196 to £1,032,292, and the debt has increased from £55,125 to £700,654. This debt is the monument to the governing Socialistic idealists. Long ago people smiled broadly at the effeteness of the Metropolitan Board of Works; but the same people are not altogether sure now that there has been a change for the better. The successive stages in the "betterment" of the government of London have brought into being the County Council and the Borough Councils, and with them an increase (as the "Standard" reminds its readers) in the average rates from 5s. to 8s., and the vane appears to be locked in the same direction. It is not denied that there has been work that has been done well, but that is heavily discounted by that which has been done ill and prodigally; and the communities to-day are bemoaning their fate that they are—not so much through the changes in the styles of the administrative bodies, as through the changes in the *personnel* of those bodies that an extended polyarchy has begotten—paying dearly in consequence for improvement against the reasonable cost of which alone for the value conferred they would not have raised a single complaint.

One of the most lamentable actions of the Battersea Borough Council has been the provision, in this working-class community, of a municipal electric lighting undertaking. The debt of the borough to-day, it is said, has passed three-quarters of a million sterling; and nearly a third of this the electric lighting undertaking has brought into existence. Up to March last, the deficits upon the working of the undertaking totalled to about £12,000; and they would have amounted to more if the Council had not, through the public lighting, made the ratepayers pay several thousands of pounds extra towards the support of the concern. In 1888-9, the public lighting cost £7182; in 1902-3, £11,292; and now, a correspondent in our morning contemporary informs us, the excess on what formerly obtained is some £6447 per annum, or an addition to the rates of 1½d. in the pound. And, through recent votes, the public lighting account by electricity is to be still further extended. The "Progressive" section of the Council contend that they have performed a real public service by providing electricity for private use at 4d. per unit, while in Company districts the price is higher. This very fact proves the deceitful character of the argument. The private service at 4d. per unit is only made possible by the additional thousands taken from the pockets of the ratepayers for extravagant public lighting; in other words, the whole of the ratepayers are made to contribute to the provision, for the comparatively few, of cheaper electricity than would otherwise be the case. If the ratepayers, too, would only look a little closer into the municipal accounts, they would find that not only through the public lighting, but in other ways, they are the victims of glaring pretence and misleading statement. It transpired only at the last meeting of the Battersea Council that the borough spent in opposing the electricity supply schemes in Parliament last year about £800; and this is to be a charge upon the common funds instead of upon the Electric Lighting Department. Of such are the ways in which the ratepayers are being deluded.

### Gas Stock Quotations.

A peculiar point connected with our Stock and Share List has just been unveiled by a complaint made by an esteemed correspondent that the price of a certain stock was at a very low figure—much below, in fact, the prices at which private dealings have been made through the office of the Company in question. It is a Provincial Company whose stocks are held tightly by those

who are fortunate enough to be in possession; and transactions are very rare, and then not, so far as we gather, through brokers. The prices of all the shares and stocks in our table are compiled entirely from the Official Lists, and not from any private sources of information. The stock in question was included in the list of a Provincial Exchange about three years ago; and, instead of taking the ordinary course that gas stocks have been pursuing of late, the quotation has at intervals been diminishing, and for no apparent reason. This has now been accounted for by communicating with the Secretary of the Stock Exchange referred to; and his explanation is that the reduction has come about by "the price having been reduced each half year as the stock has been marked *ex* dividend." In the absence of any recorded bargains, of course the Exchange could hardly be held to be blameworthy for this error in the periodical marking down. If, however, it had continued, the price would not have been long before it got below par. It is an illustration of the difficulty which attends the quotation in the Official Lists of shares and stocks in which there are practically no dealings. The only way in which the quotations in such instances can be maintained at their rightful figure is for the Secretaries of the Companies to communicate to the Secretary of the Exchange prices at which dealings are made (if they are not likely, through a broker, to come to the knowledge of the Stock Exchange quoting them). By so doing in this case, the price has been restored to its proper figure. It would not, we may add, be prudent for the "JOURNAL" to accept for its stock and share table any but the figures appearing in the Official Lists.

## The Supervision of Road Reinstatement Work.

The case which came before the Court of Appeal on Monday last week, as reported in another column, seemed in its initial stage to be likely to give rise to serious disputes between local authorities and companies having statutory power to open the streets. The point to be settled was whether the Corporation of Westminster were entitled to charge the Metropolitan Water Board, as successors of the New River Company, an additional 10 per cent. to cover the expense of superintending the work of making good the pavement of the streets after this had been disturbed through pipe-laying operations. One of the Metropolitan Magistrates stated a case for the Divisional Court, who held that the Corporation were entitled to make such a charge as a reasonable expense under section 114 of the Metropolis Management Act, 1855. On appeal to the Higher Court, however, the Corporation admitted that, though they had been put to extra expense, the 10 per cent. could not be maintained. Thereupon their Lordships sent the case back to the Magistrate for him to ascertain whether the claimants were in fact entitled to anything; and he decided, after having heard evidence, that they were not. The Corporation themselves undertook the work of reinstatement, and did not incur any substantial additional outlay for supervision, as compared with what they would have had to bear in supervising a contractor's work. They accordingly failed in their claim, and they have to pay the costs all through. Mr. Danckwerts, representing the Water Board, tried to get the Court to express an opinion on the general question of the justness of the 10 per cent.; but their Lordships very naturally declined to adjudicate upon what they rightly called a purely "academic" point. It must not be concluded, therefore, from the decision in this case, that the "extra" will not be allowed under different conditions.

## The Rate-Supported Unemployed.

As the question of relieving the unemployed by private subscriptions is now very much in evidence, it may not be out of place to call attention to the provisions of the Unemployed Workmen Act of the past session, by which Metropolitan Borough Councils are empowered to make a contribution to a Central Distress Committee to such an amount as would not exceed the sum produced by a rate of ½d. in the pound upon the assessment. This is not an overwhelming figure; but the Local Government Board have power to authorize a Council to double it. This is a point on which it is specially necessary to keep a sharp look-out, because before objections could be raised the sanction might be given. Although probably no one would begrudge the smaller addition to his assessment, many ratepayers would feel the weight of the larger one; for it must not be forgotten that rates are in many cases paid by people who are themselves but little removed from a position of destitution. This is particularly the case in Stepney, where the rates range from 7s. 8d. to 9s. 6d. in the pound. The ratepayers consequently look with some alarm at the possibility of an increase; and the Chairman of their Union (Mr. F. L. A. Gibbs) has addressed a letter to the Local Government Board to express the hope that no application has been made by the Borough Council for authority to exceed the minimum. He does not ask that, should they do so, their request may not be granted; but, reading between the lines of the letter, this is what is meant. He points out, as has often been done in these columns, that the largest contributors to the rates are incorporated and limited liability companies, who have no right to vote, and consequently no power of control; and yet, according to the new Act, those who obtain relief under it are not disfranchised. It is scarcely surprising, therefore, that these bodies strongly resent being compelled to contribute to the fund on such inequitable terms.

## High-Pressure Gas Lighting and Flame Arcs in the City.

There is one thing of which the electric lighting interests cannot complain; and it is that they have no one in the Common Council of the City to speak for them on every conceivable occasion. It has come to this now that gas cannot be mentioned in the historic chamber without some one bobs up, and seeks for special favour on behalf of the Electricity Company. There is another thing of which the electrical interests may rest assured; and it is that gas lighting has won for itself, as a vote in the Council last Thursday declares, the favour of a decided majority of the Council, notwithstanding the frantic efforts of the Electric Lighting Company to try to mislead the members of the Council as to what they could do with flame arc lamps, by centralizing examples placed close together at each end of Queen Victoria Street. We have had reason for believing that these eye-irritating flame arc lamps are not liked by the City authorities, in view of the large amount of traffic in the City; and in this we are confirmed by the statement made last Thursday by Mr. A. C. Morton, the Chairman of the Streets Committee, that: "The lights at the Mansion House are an absolute failure. The way they *glared* in comparison with the soft light of the gas was very noticeable." He also mentioned that the police do not like the flame arcs. And in another part of his speech, he said: "There was no doubt as to the success of high-pressure gas lighting in the City. The arc lamp was a failure. It wobbled, it glared, and it went out. It was not, to put it in the mildest possible way, a success." It is highly satisfactory to have this testimony after the tempestuous and foggy weather that we have had lately. With high-pressure gas lighting a success through that weather, it will be a success under any atmospherical conditions. Some small extensions of the high-pressure gas system were agreed to at the meeting; the resolution being passed with only four opponents. After this, it is pertinent to ask what impression has the flame arc demonstration made upon the City Fathers? The old complaint of the Electricity Company that they were not allowed to show what they could do has all along been false in view of the flame arcs by the Mansion House; and it is still more so now that they have made the lighting of Blackfriars Bridge Approach hideous by intermingling the light of the flame arcs with that from the high-pressure gas lamps. Of course, time must be allowed the Electric Supply Company to complete their arrangements for disconnecting the deposed lamps; but the sooner the Corporation insist upon the Company making a commencement with those arrangements, and upon them ceasing to befool the Council, the sooner will the eyesore of disused electric columns be removed from Queen Victoria Street, Fleet Street, and other places.

## The Institute of Directors.

The efforts of Lord Avebury on behalf of private enterprise are well known; and his duties as President of the Institute of Directors must be as congenial to him as they are advantageous to that organization. The Institute is not an old one—the second annual dinner was held recently—but it is making rapid strides; no less than 250 new members having been enrolled since last year, which has brought the total membership up to nearly 1000. A Charter has been applied for, a journal is in contemplation, and the Institute has already the nucleus of a library. From time to time interesting papers are contributed; and the Council carefully watch Bills pending in Parliament. Already the Institute

has been applied to by the Board of Trade for an opinion on certain questions under the Companies' Acts; and with all the advantages it offers (and the fact that the subscription is only the nominal sum of a guinea a year), the number of members should continue steadily to increase. At any rate, in spite of municipal activity in trading directions, there still remains a large field for the gathering of recruits. In proposing the toast of the Institute, Lord Duncannon remarked that one of the greatest difficulties that Directors—especially those of big concerns—had to deal with was the question of the increase of rates. They had, as Directors, no representation; but the money was spent for them, and very often they had to make excuses to shareholders for loss of dividend in consequence of high rates. This is, of course, quite true; and there seems good ground for the hope that, by joining the Institute, Directors may be taking a step that will prove beneficial not only to themselves but also to the companies on whose Boards they are serving. In responding, Lord Avebury could hardly avoid making some reference to the question of municipal trading, with regard to which he has taken up so uncompromising an attitude. He said there were present at the dinner Directors of water companies, gas-works, tramways, and docks. Some people would like to see all these concerns, and many others—including steamboats—worked by the Government or by Municipalities; but he thought there was a change of feeling in this respect. Whether or not this hopeful view is justified, one thing is quite certain—that it will be a long time before there ceases to be any use for such an organization as the Institute of Directors.

### The Qualifications of Secretaries.

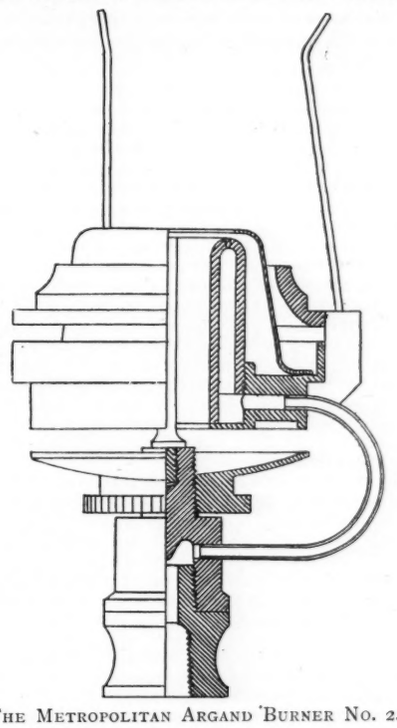
Another body which is intimately connected with Company work is the Institute of Secretaries. This Society is older than the Institute of Directors, having been founded fourteen years ago; and it already has a Royal Charter, and a membership of considerably over 3000. Among the useful work which the Institute has performed is claimed active assistance in the amendment of the Companies Act, and the practical creation, by means of the Charter, of secretaryship as a profession, as each member has practically now the whole moral force of the Institute at his back. In addition to this, the funds of the Institute are available as a defence fund for righting its members' wrongs, providing these result from unimpeachable endeavours to do right; and there is a benevolent fund which may assist necessitous members or the relatives of those deceased. These were the advantages put forward last week by Mr. Russell Day, the Secretary of the Institute, in the course of a paper entitled "Secretaries." The author dwelt upon the need of aspirants for such a position as that of Secretary possessing some certificate of fitness; and here, again, the Institute affords him an opportunity of securing what he requires. This fitness is not easily attained, according to Mr. Russell Day, for he sums up as follows the qualifications a Secretary should possess: He must have business capacity, a knowledge of procedure at meetings, integrity, self-reliance, circumspection, independence, readiness, good memory, broad views, the grasp of detail, carefulness, a clear understanding, and a concise method of speaking and writing. Then he must have the capacity to manage, and be able to maintain discipline; he should be resolute and methodical, never hurried or distracted. He must be familiar with the rules and regulations and with the legal enactments relating to the undertaking with which he is associated. He must be conversant with forms, books, and office routine, and with book-keeping, and must clearly understand the broad distinction between capital and revenue. He should understand exchange, interest, transit, advertising, &c.; while linguistic attainments, essential in some cases, are in almost any secretarial position valuable. In addition to setting forth this comprehensive list of qualifications, the author made some remarks as to the remuneration of Secretaries, which he said roughly might possibly be one-thousandth of the capital involved. Thus Secretaries who had to do with millions of capital might be paid as many thousand pounds per annum; those concerned with so many hundreds of thousands of capital might receive as many hundreds of pounds; and so on. He was, however, careful to point out that this scale was not intended for general application, but was merely meant to show the various gradations of capital and of salaries in bulk. The services rendered in each case, of course, vary so much that remuneration becomes a matter of special arrangement.

## THE NEW GAS-TESTING BURNER FOR LONDON.

**Adoption by the Metropolitan Gas Referees of the Burner Devised by Mr. Charles Carpenter.**

We have been informed by the Metropolitan Gas Referees that the "Metropolitan Argand Burner No. 2," devised by Mr. Charles Carpenter, will be prescribed for testing the illuminating power of gas in the Metropolis, under the London Gas Act which comes into force on the 1st of January.

In the editorial remarks last week on the projected gas legislation for next session, the importance was advanced of publication being made as early as possible of the decision of the Metropolitan Gas Referees regarding the burner to be prescribed under the London Gas Act of this year for testing the various descriptions of gas in the Metropolis. The matter is of importance, not only to the London Gas Companies, but to all Companies who are seeking statutory authorization in the coming session to reduce the illuminating power of their gas. The decision has therefore been awaited with immense interest, not to say anxiety, as, of course, upon the decision of the Referees largely hung the question as to whether or not there was to be a cessation of the contest over the method of testing. In view of the fact that many of the Companies seeking a change next session in their illuminating power will desire to adopt the burner that has been adjudged to deal



The Metropolitan Argand Burner No. 2.

fairly by gas of different qualities, the foregoing announcement has come very opportunely; and we have to acknowledge the courtesy of the Gas Referees in permitting the definite publication of the information in to-day's issue of the "Journal," as it may assist in the drafting of clauses in the Bills that have to be deposited by the end of next week. Of course, the Gas Referees have now to prescribe the methods governing the use of the burner; but there will be no information available on this head until the revised "Notification" is published. This, however, is a matter that can be easily provided for in the drafting of the testing clauses. Further reference to the subject is made in our editorial columns.

It will be recollected that the first public intimation that the three London Gas Companies had jointly submitted Mr. Charles Carpenter's burner to the Gas Referees was made by Sir George Livesey at the meeting of the Gas Companies' Protection Association, the proceedings at which were reported in the "Journal" for Oct. 31; but that Mr. Carpenter had been working at the question of the air adjustment of the argand burner was shown a fortnight previously by the publication in the "Register of Patents" of an abstract of his patent specification.

Readers will remember that the first step taken in the direction of the scientific use of an argand burner for gas testing was when the Gas Referees decided to burn the gas so as to obtain a fixed luminosity of flame. This answered fairly well for coal gas, but came to grief for mixtures; and still more so when it was proposed to apply the principle to poorer gases. The Departmental Committee, too, reported in favour of burning gas at a fixed rate; and to enable an argand burner to be scientifically used under

these circumstances, it was necessary to provide an air adjustment. In Mr. Carpenter's burner, or (as it will be known in the future) the Metropolitan Argand Burner No. 2, the regulation of the air has been successfully effected. The flexibility of the burner will be realized when it is borne in mind that it was put forward by the Gaslight and Coke Company on behalf of their 16-candle coal and oil gas, by the South Metropolitan Gas Company on behalf of their 14-candle coal gas, and by the Commercial Company on behalf of their 14-candle coal and oil gas. All three London Companies will therefore be having their gas tested by the same burner, the same chimney, and under identical conditions. This surely is getting as near uniformity as the London County Council can possibly desire. Mr. Carpenter is to be heartily congratulated on having devised a burner that has so successfully met the requirements of the Gas Companies, and earned the complete approval, as shown by its adoption, of the Gas Referees.

## REMOVAL OF NAPHTHALENE FROM COAL GAS.

By Dr. H. G. Colman.

[Third Article.]

In addition to the investigation of the crude coal gas at various points in its passage through the condensing system, Messrs. White and Clary have further examined the effect produced on the naphthalene during the passage of the gas through the scrubbers, and have come to important conclusions with regard to the effect of the latter on the subsequent deposition of naphthalene from the gas.

The immediate reason which led to the extension of the investigation to the scrubbers was the amount of naphthalene present in the gas as vapour at the outlet of the Pelouze and Audouin separator at several works, as shown by the author's tests. This was so low that none of it could be deposited at any temperature to which the gas was likely to be subsequently exposed; and yet, notwithstanding this, considerable trouble from naphthalene deposits was being experienced with this same gas. From what was said in the previous article, it seems very probable that this "beatific" state of things at the Pelouze and Audouin outlet existed only in the results of the tests, and not in reality—the tendency of the method being to give too low results with regard to the amount of naphthalene vapour in the gas; and if this is the case, no surprise need be felt at the subsequent deposition of the hydrocarbon. But at the same time, quite apart from this, the changes taking place in the scrubbers, due to the presence there of ammonia and water—to which, so far as the writer knows, attention is drawn for the first time by Messrs. White and Clary—do, in all probability, play a very considerable part with regard to naphthalene deposition.

The authors point out that the tar mechanically carried forward into the scrubbers is there subjected to the action of water and alkali (ammonia), the tendency of which will be to dissolve from the tar the constituents which are most soluble in such liquor. The most soluble portions of the tar are the phenols, which are themselves valuable solvents for naphthalene; and as a result of their removal in this manner, the percentage of naphthalene in the residual tar will be increased, and that of phenols decreased, with a consequent increase in the vapour pressure of the naphthalene in the tar, which would result in a new equilibrium being set up whereby naphthalene is given off from the tar to the gas. This valuable conclusion of Messrs. White and Clary may be extended still further by inquiring into the effect of the ammoniacal liquor in the scrubbers on the vapours present in the gas, which include, in addition to naphthalene, portions of all the tar constituents having an appreciable vapour pressure at the ordinary temperature. The amount and nature of such vapours exert a very important influence in determining whether or not naphthalene is subsequently deposited from the gas in the solid form. Where vapours of liquids having a vapour pressure approximating to that of naphthalene are present in gas, these tend to separate out with the latter when the temperature is lowered; and the greater their quantity, the greater will be the tendency for the naphthalene to separate as a solution in those liquids instead of as a solid, which liquid causes no trouble, but eventually finds its way to the syphons.

Among the vapours always present in coal gas are those of the phenols, chiefly phenol itself, and the cresols. The boiling point of phenol is 184° C., that of the cresols varies from 188° to 201° C.; so that the vapour pressure of these is of the same order as that of naphthalene, boiling at 219° C.; and, moreover, naphthalene is very soluble in these liquids. Hence the quantity of these vapours present is of very great importance in determining whether or not solid naphthalene will subsequently separate from the gas. But just as the effect of ammonia and water in the scrubbers is to remove phenols from any tar present, so it will also —and probably to a greater extent—remove the phenol vapours present in the gas; and therefore, even though the gas may leave the condensing system with a sufficient amount of other vapours to prevent trouble later from the naphthalene also present, the scrubbing, by removing phenol vapours, may so alter matters that separation of solid naphthalene will then take place in the passage of that gas through the purifiers, meters, holder inlets and outlets, and in the distributing system.

It appears, therefore, that the effect of scrubbing the gas in the removal of the ammonia, &c., is twofold, so far as naphthalene is concerned. In the first place, by the action of the ammoniacal liquor on the tar carried forward into the scrubber, there is a tendency for the latter to give off naphthalene to the gas; thus increasing the amount present. In the second place, the liquor simultaneously effects the removal of some of the phenols present as vapour in the gas, and thus in both ways renders the gas more liable to give trouble from naphthalene stoppages at later stages.

At present there is not sufficient evidence available to determine the amount of such influence; but perhaps Messrs. White and Barnes, in continuing their work, will be able to ascertain the extent to which the vapour pressure of naphthalene in different samples of tar is increased by the removal of phenols, and also to determine the amount of their vapours removed from the gas during its passage through the scrubbers.

## DIFFERENTIAL PRICES FOR GAS.

By Arthur Valon, Assoc.M.Inst.C.E.

At the present moment, the question of charging different prices for gas supplied under varying conditions is certainly one of the most important of the subjects which are engaging the attention of those responsible for the direction of the gas undertakings of the country; and as it is only recently that this question has forced itself into prominence, it is not to be wondered at that there should be some difference of opinion on the subject. The wide divergency of opinion that exists could not be better exemplified than by the paper read by Mr. Newbigging before the Manchester District Institution of Gas Engineers, and the discussion thereon.

At the one extreme, there is the ideal of one uniform price for all consumers; and at the other, the desire to obtain business, even if it has to be done by selling gas at a loss. The majority, however, in all probability, occupy various places between these two extremes, but are all desirous of obtaining business which would otherwise go to their competitors, by supplying gas at a lower price for special purposes, if this can be done without injustice to ordinary consumers.

It has been suggested that Parliament would not tolerate any wide difference in price; and it has been pointed out, in support of this, that in Acts recently passed the discounts for large consumption have been limited to 15 per cent. But it should be remembered that when this was done there was no evidence to show that 15 per cent. was not sufficient to meet the requirements of the undertakings to which these Acts applied; and it should furthermore be remembered that the principle of differential prices has been sanctioned by Parliament in the case of slot consumers.

The statutory restrictions as to varying the price of gas appear to be due to a desire on the part of the Legislature that all consumers shall be fairly treated; and there is no reason to suppose that gas undertakings will be prevented from making special terms under special circumstances, provided that it can be conclusively shown that the circumstances warrant the terms, and that the ordinary consumers are not unjustly treated. The most important question therefore to be decided is, What are the special circumstances which warrant special terms? The factors which govern the price at which a consumer can be supplied may be enumerated as follows:—

1.—Amount of yearly consumption.
2.—Ratio of the maximum consumption per day to the total consumption per year.
3.—Ratio of the maximum consumption per hour to the maximum consumption per day.
4.—Period of the day or year during which the supply is required.

It now remains to consider what items in the cost are affected by these four factors and to what extent.

(1) *Amount of Yearly Consumption.*—It seems clear that the only items of cost which are affected by the amount of the consumption are those the total of which are wholly or in part governed by the number of consumers, and not by the amount of gas consumed. These can be reduced in the proportion of the amount of the particular consumption to the average consumption per consumer. Take, for instance, collection. It costs as much to collect a small account as it does a large one. If the same price is charged for gas, the amount charged for collection varies in proportion to their several consumptions—that is to say, the large consumer pays more than is fair. Those items, therefore, which are wholly independent of the amount of gas per consumer should be reduced in the proportion that the average consumption per consumer bears to the actual consumption by the consumer in question. In the case of those items which are only partly independent of the consumption per consumer, it is obvious that only the part which is independent can be reduced.

(2) *Ratio of Consumption per Day to Consumption per Year.*—The items affected by this are those which are not reduced by the

reduction of consumption in the summer, such as capital charges. The capital required for a certain consumption depends not on the total consumption for the year, but on the largest consumption which takes place on any day in the year. Therefore, the greater the consumption per year in proportion to the maximum consumption per day, the less is the capital cost per 1000 cubic feet produced. For instance, if a consumer takes yearly an amount of gas equal to 300 times his maximum day, while the total yearly consumption of the undertaking is only 200 maximum days, then the plant occupied in supplying this particular consumption will, in the course of the year, produce 50 per cent. more gas than the rest of the works, and the capital charges to this consumer could be reduced in the proportion of 3 to 2.

(3) *Ratio of the Maximum Consumption per Hour to the Maximum Consumption per Day.*—This will affect that part of the cost which is covered by the peak load, such as capital charges on mains, repair and maintenance of mains, and also, to some extent, capital charges on holders. These, therefore, may be treated as suggested under the head of (2), substituting the above ratio.

(4) *Period of the Day or Year when the Consumption is required.*—Under the circumstances of most undertakings, still further reductions on this head could be made if the consumption were required between 12 p.m. and 6 a.m.; but otherwise, as a usual day-load generally overlaps to some extent, it would probably not be safe to go further than suggested under (3). And, again, a further reduction might be made on the items under (2) if the supply were required wholly in the summer. It has been objected that if the plant were fully employed the year round, considerable margin would have to be allowed to cover repairs; but this hardly seems in accordance with the facts. The part of the plant upon which a margin would be chiefly required would be the retorts. It is not unreasonable to assume that, on an average, a bed of retorts will last two years, and that it would not take more than a month to reset. If, therefore, each setting had to be replaced once in two years, and it took a month to do it, it is evident that each setting would be out of use for one-twenty-fourth of its life. Therefore a margin of 5 per cent. would be sufficient.

The several reductions under the foregoing head appear to be quite justifiable and in accordance with the principle of treating all consumers equally. But further reductions have been advocated in order to meet the special case of the supply of gas for power in competition with producer gas. Chief among these is a still further reduction in capital charges, on the plea that to meet new business the cost of extensions per 1000 cubic feet sold is less than the existing capital sold. But if reductions such as these are made, it cannot possibly be contended that all consumers are treated equally, though it may still be possible to show that they are not treated unjustly. It is abundantly clear that, without a considerable reduction in price, the business in gas for power will pass to others; so that the fixed charges will still remain to be borne by the ordinary consumers. If the new business can be secured, however, the cost of manufacture will eventually be reduced, owing to the enlargement of the scale of operations, and the ordinary consumer will benefit by this reduced cost.

This argument cannot, however, be used in favour of any arrangement by which charges that are increased by the extension of the business would be left to be borne entirely by the ordinary consumers. Unless the price charged to any consumer covers everything that it costs to supply him—including interest on the plant employed—it is evident that he is being supplied at the expense of other consumers; and certainly it is unlikely that any such arrangement as this would ever be sanctioned by a Parliamentary Committee.

## GAS COMPANIES' (REMOVAL OF SULPHUR RESTRICTIONS) BILL.

From Mr. F. E. Cooper, the Secretary of the Gas Companies' Protection Association, we have obtained a copy of the Bill, intituled "A Bill to remove the Restrictions in respect of Sulphur Compounds (other than Sulphuretted Hydrogen) now Imposed upon certain Gas Companies." This is the Bill that has been promoted unitedly by several Companies, on the initiative of the Gas Companies' Protection Association. Messrs. R. W. Cooper and Sons are the Parliamentary Agents for the measure. The preamble refreshes the memory as to the course of events and the report of the Departmental Committee on the subject; and therefore we reproduce it *in extenso*.

Whereas the several Gas Companies (hereinafter severally and collectively referred to as the "Companies") enumerated in the first column of the Schedule hereto (hereinafter called the "Schedule") are, by virtue of the Acts severally set forth in their relative position in the second column of the Schedule (which said Acts are hereinafter called the "Scheduled Acts") now subject to certain statutory restrictions with respect to the testing for sulphur compounds in the gas supplied by them respectively.

And whereas a Departmental Committee known as the "Metropolitan Gas Committee" was appointed by the Board of Trade in the year 1904 to inquire and report as to the statutory requirements relating to the illuminating power and purity of gas supplied by the Metropolitan Gas Companies, and as to the methods now adopted for testing the same, and as to whether any alteration was desirable in such requirements or methods, and, if so, whether any consequential alteration should be made in the standard price of gas,

And whereas the said Committee, after taking evidence on the various matters referred for inquiry to them, reported (*inter alia*) as follows:—

> With regard to the injurious effects of the presence in gas of sulphur compounds other than sulphuretted hydrogen, the evidence is conflicting. But it is not disputed that only a small percentage of the gas undertakings in the United Kingdom (whether in the hands of Companies or Local Authorities) are required to take these sulphur products out of the gas they supply. Nevertheless, it does not appear that any complaints are made by the inhabitants of other districts on the ground that the gas thus unpurified causes injury to health, or is more destructive to articles such as leather, &c., than it is supposed to be in London. In the face of this striking fact, the Committee are of opinion that those who contend for the maintenance of the clauses relating to sulphur compounds (other than sulphuretted hydrogen) have not sufficiently shown that their abolition in the case of the London Companies would be detrimental to the public. On the other hand, all the witnesses on behalf of the Companies have spoken with much emphasis of the anxiety caused to the management on account of the uncertain action of the lime purifiers, and the knowledge that the slightest excess of impurity will render them liable to the odium of Police Court proceedings; and they have laid much stress upon the nuisance to the neighbourhood which, they contend, is inevitable when purification is done by means of lime. And there is no doubt that the nuisance which is occasioned by the use of lime for extracting these sulphur products is very serious, not only by reason of the annoyance caused to the neighbourhood, but also by the deleterious effect on the workmen employed in connection with the process.
>
> After careful consideration of the evidence submitted to them on this question, the Committee are of opinion that the requirement that the sulphur impurities shall be removed to such an extent as to demand the use of lime should be discontinued; and, in view of the fact that no effective substitute for lime has been found, they abstain from suggesting the imposition of any modified restriction in place of that now existing.

And whereas the Metropolitan Gas Companies have, by virtue of an Act intituled the London Gas Act, 1905 (promoted by the London County Council), and the South Suburban Gas Company have, by virtue of the South Suburban Gas Act, 1905, been severally relieved of liability to forfeiture for sulphur impurities other than sulphuretted hydrogen.

And whereas it is expedient that the Companies should be relieved of the existing restrictions imposed upon them in respect of sulphur compounds (other than that of sulphuretted hydrogen) in the gas supplied by them, and to this end that the Scheduled Acts should be repealed to the extent shown in the third column of the schedule.

After the usual formal preface, the Bill proceeds:

1. This Act may be cited for all purposes as the "Gas Companies' (Removal of Sulphur Restrictions) Act, 1906."

2. From and after the passing of this Act, the Companies shall not be liable to any forfeiture by reason of the presence in the gas supplied by them respectively of sulphur compounds other than sulphuretted hydrogen; and the Scheduled Acts are to the extent shown in the third column of the Schedule hereby repealed.

3. All costs, charges, and expenses of and incident to the preparing for, obtaining, and passing of this Act or otherwise in relation thereto shall be paid by the Companies.

The schedule to the Bill sets out the names of the promoting Companies, the Acts affected, and the extent of their repeal. The Companies are the British Gaslight Company, Limited (Hull, Norwich, and Staffordshire Potteries), Cambridge University and Town Gaslight Company, Harrow and Stanmore Gas Company, Hastings and St. Leonards Gas Company, Hampton Court Gas Company, Ipswich Gaslight Company, Newcastle-upon-Tyne and Gateshead Gas Company, Reading Gas Company, Richmond Gas Company, Shrewsbury Gaslight Company, Tunbridge Wells Gas Company, Walker and Wallsend Union Gas Company, Wandsworth and Putney Gaslight and Coke Company, and Wolverhampton Gas Company.

## Notes for the Society of British Gas Industries.

From the National Electrical Manufacturers' Association come two items of interest which the members of the new Society of British Gas Industries may like to have for future reference—perhaps guidance.

Concerning the recent Electrical Exhibition at Olympia, Mr. W. Davenport, the Secretary of the Association, writes: "The financial affairs of the recent exhibition are now so far advanced as to enable me to inform you that the exhibitors will receive a rebate of 25 per cent. upon the sums paid by them for space, and a very considerable sum will be available for benevolence. The fact that the exhibition was an unqualified success from every point of view is satisfactory, not only to the Executive Committee, but to the exhibitors and trade generally."

The Association are also sending out the following circular in response to applications for Christmas boxes or New Year's gifts: "I beg to inform you that, at a recent meeting of the members of the above Association, it was unanimously decided that, owing to the enormous increase in the number of applications, they must reluctantly discontinue, as from this date, the practice of subscribing to Annual Beanfasts, Christmas-Boxes, New Year Gifts, &c. In consequence, thereof, the members of the above Association have unanimously agreed to discontinue this custom."

**Yorkshire Junior Gas Association.**—We learn from the Hon. Secretary of this Association (Mr. C. T. B. Roper, of Bradford) that a meeting will be held next Saturday afternoon at the Town Hall, Dewsbury, when the President (Mr. E. J. Sutcliffe, of Bradford) will deliver his Inaugural Address, which will be followed by "Notes on a Visit to the Amsterdam Western Gas-Works," by Mr. W. Cranfield.

# THE GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 698.)

THE Stock Exchange opened rather dull on Monday, under the influence of the feeling at the close the previous Saturday, but it got better very quickly. A leading feature was the firm advance of the higher class of securities; Consols being an especially strong market. Business was fairly active, despite the settlement of a somewhat heavy account—an operation which proved insurmountable to two small operators. On Friday, things fell back again, in contemplation of the political uncertainty at home, and the terrible uncertainty as to the true state of affairs in Russia. Thus, realizing was the rule. The week closed without much recovery. In the Money Market, there was a strong demand; but the supply was equal to meeting the occasion, and when the demand relaxed, rates fell quite easy. Discount rates also were easier. Business in the Gas Market continued very active in the aggregate, but it was not so well distributed through the list, two companies engaging the bulk of it. Movements were somewhat irregular; but for the most part changes were in favour of higher figures. In Gaslight and Coke issues, there was a good, steady business in the ordinary at very even figures. One bargain was done at 101; but all the rest were above that figure, and 102 was repeatedly marked. Not much was recorded in the secured issues. The maximum changed hands at 90; the preference at 111½; the debenture at 87½ and 88—the quotation advancing a point. South Metropolitan was quite inactive and unchanged. What few transactions took place were between 132½ and 133. One bargain in the debenture marked 87½. Commercials were very quiet too. The 4 per cent. was done at 117½; and the 3½ per cent. at 112½ and 113½. Business in the Suburban and Provincial group was extremely light. Alliance old was done at 21⅜—the quotation receding half-a-point. Bournemouth "B" marked 17¼; and British, 43½. Brentford old was done once at 262, ditto new at 201, and West Ham preference at 124¾. Both issues of Tottenham and Edmonton had a nice rise, without business marked. On the Liverpool Exchange, the quotation of Shrewsbury, which had long been left standing at old figures, was put up 10. In the Continental division, Imperial again almost monopolized attention. The approaching bonus we mentioned last week has been officially announced. By capitalization of reserves, the proprietors will receive a bonus of 30 per cent. of capital; the rate of dividend being at the same time reduced from 10 to 8 per cent. As 10 per cent. on £100 = £10, and 8 per cent. on £130 = £10 8s., the late rise in the price of the stock is explained; and it was maintained last week. There were many transactions, and they ranged from 233 to 236. The debenture was done at 98. Union was done at 129 and 130, European at 22½, and ditto part-paid at 15½. Among the undertakings of the remote world, Bombay was done at 7, Cape Town at 17⅛, and San Paulo at 13⅜. Buenos Ayres was a little lower. Primitiva ordinary was done at 7⅛ and 7 1/16, ditto preference at 5 5/16, and ditto debenture at par, *cum div.* Monte Video marked 12¼, and River Plate 13.

The closing prices are shown in our Stock and Share List on page 698.

# ELECTRIC LIGHTING MEMORANDA.

**Preferential Treatment of Municipal Electricity Undertakings—Poplar an Example—Under-Assessment of the Works — The Public Lighting Scandal—Loans and Deferred Payments—The Surplus Profits Swallowed up—A Black Outlook.**

THE preferential treatment that local authorities accord to their own undertakings, to the detriment of the ratepayers generally, has been a matter to which attention has been frequently directed in these columns. To show that a so-called productive undertaking is remunerative, they resort to all manner of petty expedients for shifting expense directly from the concern to the general fund of the district, and muddle things in such a way that it requires the cutest of financiers to get a proximate knowledge of the rights and wrongs of the municipal accounts. That is one of the methods by which ratepayers are hoodwinked. And others have respect to the affectionate regard that the authorities have in the matter of assessing their own "productive" electric light undertakings (for they are virtually their own assessors) on the one hand, and the clever system they adopt for compelling the ratepayers to pay, *nolens volens*, for an extravagant system of public lighting on the other. These latter are artifices that ratepayers, if they were not so apathetic concerning the doings of their local representatives, could easily discover, and see how these and the several other deceptions practised in connection with, and the consideration shown to, these civic ventures bear hardly upon themselves without any tangible advantage accruing, for the sole purpose of enabling the municipality to put a good face upon their speculations. We are reminded of these things by correspondence that Mr. I. J. Booth, of the London Trading Bank, Limited, has had with the officials of the Poplar District Council. Mr. Booth is a ratepayer in the area governed, or rather misgoverned, by the Council in question; and, as a ratepayer, he contends, and is in a position to prove (as the documents before us disclose), that he among the other ratepayers—and naturally the Gas Company as a large ratepayer comes to mind—suffers unjustly by the methods adopted by the local authority to show a "profit," albeit of a fictitious nature, upon their electricity concern. The unfair rating of the undertaking is the principal matter to which Mr. Booth has of late been directing notice; and steps are being taken to invoke the aid of higher interested authorities than the District Council to redress the wrong inflicted, in consequence, upon the ratepayers. This is not a question of taking money from one pocket and putting it into another. Having a "profit" on the undertaking no matter what the use to which the balance is put, does not wipe out the iniquity of obtaining it by an injustice on the general body of ratepayers, particularly the large ratepayers, and more especially as upon this fictitious profit income-tax has to be paid. There ought to be some means of protecting the ratepayers against this kind of thing; and the best that we can wish Mr. Booth is success in exposing the Poplar Council in this matter, in the hope that it will initiate a general endeavour to assure that the accounts of municipal trading ventures are constructed and ordered on sound and correct principles.

Now let us see the grounds upon which Mr. Booth proves, that he, in common with the other ratepayers, is injured and aggrieved by the greatly deficient rating of the Poplar electric lighting works. By the records of the Borough Council up to July 13 last, the total assessment of the electricity works was only £1880. According to the minutes the Electricity Committee presented to the Council on the date named, there had been a reassessment of the works (the total capital expenditure upon which to March, 1904, had amounted to no less than £194,300); and it is not astonishing to learn that the Committee had "agreed the figures," and asked the Council to approve of their action. The farcical nature of this proceeding is shown by the amounts of the reassessment. The rateable value of the works was placed at £1678, of the reducer house at £205, and of the cables at £1877, or a total of £3760. In the last-issued abstract of the accounts of the Council, there are set out the items of the capital expenditure; and these Mr. Booth groups in sections, and submits that the assessments should be upon the scale set out in the London County Council paper No. 795, dated September, 1904—thus

| | | | | | | |
|---|---|---|---|---|---|---|
| Land | £3,123 9 9 | × | 4 p.c. | = | £124 18 0 | |
| Buildings | £23,892 13 2 | | | | | |
| Reducer house | 1,534 14 5 | | | | | |
| | £25,427 7 7 | × | 5 p.c. | = | 1,271 7 0 | |
| Machinery | £43,494 13 5 | | | | | |
| Reducer house | 148 15 0 | | | | | |
| Accumulators | 2,814 7 7 | | | | | |
| Transformers | 8,894 10 5 | | | | | |
| Electrical instruments | 2,261 1 8 | | | | | |
| ,, reducer house | 1,182 10 8 | | | | | |
| | £58,795 18 9 | × | 10 p.c. | = | 5,879 11 10 | |
| Mains | £87,037 5 3 | × | 5 p.c. | = | 4,351 17 0 | |
| Public arc lamps | £12,752 0 0 | | | | | |
| Incandescent lamps | 2,029 2 3 | | | | | |
| | £14,781 2 3 | × | 5 p.c. | = | 739 0 0 | |
| | | | | | £12,366 13 10 | |

Thus, accepting the scale of the London County Council, the gross rateable value should be at least £12,366 13s. 10d., and it may possibly be more, as the percentage on the outlay for mains would, Mr. Booth believes, on expert opinion, be taken at 10 per cent., instead of 5 per cent. Of course, there must be the usual deductions to arrive at the rateable value. The measure of these deductions can be ascertained from figures which have been obtained from Mr. Skeggs, the Clerk of the Valuation and Rating Department of the borough. The "agreed" rateable value already referred to is £3760; and, according to Mr. Skeggs, the gross value is £5640. Applying this latter figure to Mr. Booth's £12,366, it is found that the gross valuation is some £6726 below what it should be, so that the net rateable value should be considerably more than doubled—in proportion it should be £8244. In consequence of this, the amount paid as rates and taxes in the year ending March 31, 1904, was only £908 13s. 4d.; whereas, if the figures Mr. Booth advances are approximately correct, then the sum (the rates are 12s. in the pound) should have been nearer £4946 in rates alone. This would have been the electricity works' contribution to the general rates and taxes, and would have made the balance (£2985), after meeting interest and sinking fund, look decidedly smaller.

This shows one way in which ratepayers are bamboozled by local authorities such as the Poplar District Council. There is another way, and that is in respect of public lighting. At the advent of the Poplar Borough Council, the cost of the public lighting stood at about £6000 a year. The charge for electricity alone for public lighting in the year ending March, 1904, was £9231, and, adding on to this upwards of £3000 for gas, puts the cost of the public lighting up to over £12,701, or double what it was before. It is noticed that in the year ending March, 1904, the arc lamps in use numbered 320, and the incandescent electric lamps were arranged in clusters—making, in all, 482 24-candle power and 206 64-candle power posts. The

incandescent gas-lamps numbered about 865. The average cost of these was £3 9s. each, and the illuminating power was (say) about 50 candles. Compare this price and illuminating power with the £5 6s. 9d. paid for the 24-candle power electric lamps and the £14 4s. 8d. paid for the 64-candle power ones. The price of the arc lamps in the year named ranged between £29 3s. 8d. and £19 16s. Beyond the inconvenience of late lighting, in the streets where the incandescent electric lamps are placed, the lighting is as bad as in the days of the old flat-flame gas-burners. To walk from these streets into those of Mile End where incandescent gas-lamps are placed, is an object-lesson for ratepayers and local authorities. It is observed that the cost of attending to and repairing the arc lamps in the year was £1307; and the cost of attending to and repairing the incandescent electric lamps was £761. In this public lighting department, we have the second direction in which the ratepayers are made to unnecessarily spend money to yield support to the electric lighting undertaking. They are deceived on the one hand by under-assessment, and on the other robbed by flagrant extravagance in the matter of street illumination.

Then there is a question in regard to the repayment of loans which shows how very real is the unsubstantiality of the "profit-balances," and what uncertainty faces the ratepayers in the future. It will hardly be credited by men of financial acumen that here we have a municipal undertaking that commenced operations in 1901-2, with an expended capital on March 31, 1904, of £194,300, and the total repayment of loans only amounts to, according to the published accounts, £2493. In a report to the Council on Jan. 26 last, the Electrical Engineer makes a clean breast of the condition of the loans account. The total borrowed capital was then reported to be £218,933; the repayments "deferred," £11,125; the repayments made £1006; and the repayments then due were £3044 18s. 2d. Now see the effect, in deluding the ratepayers, of deferring the repayments. Says the Engineer: "If the repayments had not been deferred for 1901, 1902, 1903, we should now have a deficiency on account of revenue amounting to £2455 8s. 7d., instead of a surplus [the accumulated surplus] of £6892 13s. 5d." Look, too, at all the significant statements to be found in the succeeding part of this report—

> The repayment of loans this year amounts to £3044 18s. 2d., as against £803 7s. for last year—an increase of £2241 11s. 2d., and, in addition, the amount of repayments deferred until next year is £1777. The repayments on loans next financial year, 1905-6, *on money already borrowed*, will amount to £4362 13s. 6d., as against £3044 18s. 2d. for this year—an increase of £1317 15s. 2d. The above statement does not deal with any public lighting capital; this having been *transferred to the general borough fund account* from April 1 last.

The capital for public electric lighting is considerably heavier than for gas lighting, so that the ratepayers are again victimized by this transfer of additional capital expenditure incurred for the benefit of the electricity undertaking to the general borough fund account. The report proceeds—

> In view of the reduction in the price of the public lighting, which already represents up to Sept. 30 a saving to the borough of £1048 12s. 7d., the reduction in the power rate to consumers, which I estimate will reduce the revenue by approximately £700, and the statement of accounts to September last . . . which showed *a loss on the six months' working* of £2235 15s. 1d., I do not consider it at all advisable to assume that the gross profits this year will meet all our liabilities on account of capital charges. Therefore we must be prepared to pay the repayments of loans stated above out of the surplus to March last, and, after doing this, we shall only have a small credit balance for general working purposes, and for providing a reserve fund (which the Board of Trade state should equal 10 per cent. of the capital expenditure) and to answer any future deficiency.

Therefore it is found that the works are under-assessed, that the ratepayers are paying an exorbitant sum for street lighting, that reductions of price have become imperative to meet competition, that the repayments of loans have been deferred, that in consequence a greater burden has been thrown on succeeding years, that the surplus balance was in January last ear-marked for loan repayments (without taking into account the increasing expenditure on capital), and that at the present time there is nothing in reserve or for meeting depreciation. The greater part of the loans have been borrowed from the County Council for 42 years; whereas a considerable portion of the plant will be completely spent long before that. In other words, the Council are pledging a couple of generations ahead for plant which a few years hence will have no useful existence.

Under all these circumstances, is it unfair to refer to fictitious profits and to the beguiling of the ratepayers by the socialistic dominators of the Council who are spending money like water? No wonder that Messrs. Yarrow and others are looking about for fresh sites for their works, so that they can shake off for good the dust of Poplar from their feet and get relief from rates which impede their industrial movement. By the foregoing examination, some light is thrown upon the dark places of the municipal management of a Metropolitan electricity undertaking; and there is no question that Poplar does not stand alone in these carefully-designed schemes for putting a fair face on what, if the accounts set out plainly the truth, would be a state of affairs that would create real alarm among the ratepayers. The ratepayers in the Poplar district must be remarkably easy-going if they can look with composure upon the present or the future of their electricity undertaking.

## PERSONAL.

Mr. W. JONES, late of the West Cheshire Water-Works Company, Birkenhead, has obtained the appointment of Secretary and Manager of the Herts and Essex Water-Works Company, for which applications were invited in the "JOURNAL" some weeks ago.

Mr. H. J. IBBOTSON has resigned his position of Engineer and Manager of the Newport (I.W.) Gas Company, and will leave England on the 22nd inst., by the P. & O. steamship *Moldavia*, for Japan, where he will represent several well-known firms of constructing gas engineers and manufacturers of the various appliances used by gas undertakings.

At the anniversary meeting of the Royal Society on Thursday, Lord RAYLEIGH, O.M., M.A., D.C.L., was elected President. His Lordship, as our readers may remember, is Chief Gas Examiner for the Metropolis, having been appointed on the resignation of the late Dr. A. W. Williamson in 1901. Lord Rayleigh is the third holder of this office since its creation; Dr. Williamson's predecessor having been Dr. Letheby.

Mr. H. HULSE, who for the past six months has been in charge of the Meadow Lane Gas-Works of the Leeds Corporation, has now been appointed permanently to the position of Manager, which became vacant on the death of the late Mr. G. Tooley, which was recorded in the "JOURNAL" for March 28 last. This decision was come to by the unanimous vote of the Gas Committee; and the greatest satisfaction was expressed at the way in which Mr. Hulse had discharged his duties since his provisional appointment.

## OBITUARY.

We regret to record the death, on Monday last week, of Mr. WILLIAM TURNER CARPENTER, who for 46 years held the position of Engineer to the Isle of Sheppey Gas Company, from which he retired about a year ago. The sad event severs one more of the connecting links between the present and the past of the gas industry. Deceased was born in Bristol in 1833, and received his training as a gas engineer from his uncle, Mr. T. Atkins, under whose supervision about 45 towns in various parts of the country were provided with gas or water. One of these was Sheerness, for the supply of which town with gas Mr. Atkins put up works at West Minster in 1858 for the new Sheppey Gas Company. Mr. Carpenter assisted his uncle in laying down the plant, and was afterwards appointed Engineer of the Company. The business gradually increased until, in 1882, it had grown beyond the capacity of the original works. These were accordingly rebuilt, and since then the consumption has risen from 41 to about 100 million cubic feet per annum. When Mr. Carpenter left the service of the Company, he was granted a pension. He was a man of resource and initiative, and as far back as 1869 invented and patented the continuous retort which is known by his name. He joined the British Association of Gas Managers in the preceding year, and was a member both of the Gas Institute and the Gas Institution. Deceased married when he went to Sheerness, and had two daughters and four sons, and three of the latter follow their father's profession. The eldest, Mr. W. J. Carpenter, is Engineer and General Manager of the Great Yarmouth Gas Company and Consulting Engineer to the Sheppey Gas Company; another, Mr. A. A. N. Carpenter, is Deputy-Engineer at the Bromley Station of the Gaslight and Coke Company; while the youngest, Mr. B. A, Carpenter, succeeded his father as Engineer of the Sheppey Company. The late Mr. Carpenter was a prominent Freemason, and was the second oldest member of the Adams Lodge, No. 158. He was W.M. in 1872. The funeral of the deceased took place at the Sheppey Cemetery on Thursday. In addition to the members of the family, it was attended by several Directors and the Secretary and Manager (Mr. H. Barber) of the Company with which the deceased had been so long associated, as well as by Mr. John Miles, the foreman, who had worked with him during nearly the whole of his career at Sheerness, and his two sons. The three local lodges of Freemasons were also represented.

**British Association of Water-Works Engineers.**—We learn from Mr. Percy Griffith, M.Inst.C.E., the Secretary of the Association, that, in addition to the papers already mentioned (*ante*, p. 540) as coming before the members at the winter meeting on the 16th inst., Mr. Baldwin Latham, M.Inst.C.E., has undertaken to write one dealing with a case of lead poisoning which recently occurred in the South of England.

**The Discussion on Mr. Newbigging's Paper at the Manchester Meeting.**—Mr. T. Newbigging has pointed out that the misplacement of quotation marks in the portion of his reply in which he dealt with Mr. Forstall's paper [p. 610, col. 2], has attributed to that gentleman the inference which the speaker drew from his statement. The sentence in question should read thus: Quoting Mr. Forstall's own words, he said: "As, under this scheme, the price paid is reduced as the consumption increases," you need only consume a large enough quantity of gas to pay nothing at all.

# MONAZITE SAND AND THORIUM.

### Additional Information from the Imperial Institute.

Our readers will doubtless remember that some interesting particulars have been published from time to time in the "Bulletin" of the Imperial Institute, on the subject of the sands which contain monazite and thorium. Some further information was furnished in No. 3 of the third volume, which was issued last week; and we reproduce it below. It is explained in the introductory paragraph, that since the discovery of thorianite, thorite, and similar minerals in Ceylon, and of monazite sand in Southern Nigeria, by the officers of the Mineral Surveys now being carried on under the direction of the Institute in these two countries, a number of inquiries have been received for information as to the methods best adapted for winning these valuable minerals from the comparatively valueless gravels and sands with which they are associated. It has been considered advisable, therefore, to publish a general statement on this subject, giving the results of experience in Brazil and Carolina, which have up to the present been the principal centres of production of these minerals.

#### Brazil.

The Brazilian monazite deposits (hitherto the chief source of thorium dioxide) have been already concentrated by natural processes. The monazite originally occurred in granites and gneisses. These were decomposed by laterization, broken up by subaërial agencies, and transported by streams to lower ground, where a series of beds of clay, sand, and conglomerates containing monazite were laid down. Where these deposits have been attacked and broken up by the sea, the material has been washed and re-washed by the waves in successive tides, so that the lighter material has been removed, and beds of monazite, ilmenite, and garnets formed within the tidal limits. These minerals sometimes occur mixed one with the other, sometimes in alternate layers, and in most cases the monazite beds are covered with a layer of other material. In some instances, where the relative level of land and sea has changed, the deposits are found above high-water mark.

The monazite beds rarely exceed half-a-metre in thickness, but occasionally reach a metre. They are lenticular in shape, thinning out towards the sea. The richer deposits only occasionally reach, and rarely exceed, a length of 500 metres along the sea shore. Their width is usually rather under 20 metres. No deposits of this type containing less than 15 per cent. of monazite have been worked until recently, and some yield as much as 70 per cent.

Most of these deposits are not renewed by the action of the sea, and will be exhausted soon; but the great deposits at Prado, which yield, according to various estimates, from 1200 to 1600 tons of monazite sand per annum, are being continually enriched by the destruction of the monazite-bearing clay cliffs at the foot of which they lie.

The methods of work on the Brazilian deposits are usually very simple. If there is a superincumbent bed of quartz sand or other valueless material, it is carefully shovelled away till "yellow sand," as the monazitic material is usually called, is left exposed. This is then loaded into sacks containing 45 kilogrammes and carried on men's heads to a series of "tanks" or wash-boxes on the banks of the nearest stream. These are placed one above the other and a current of water passed through them, which washes away the salt and the lighter material, leaving the monazite in a concentrated state. In the operations at Prado, sluice-tables are employed. Monazitiferous river gravel is now being worked on the River Parahybe. The treatment is of a scientific character. The fine material containing the monazite is first separated by means of a revolving sieve or trommel. The quartz or other valueless light material is then removed by means of Wilfley tables of the usual type, and the heavy residual portion is run through Humboldt magnetic separators, which remove the ilmenite.

It is stated that by the application of these well-known processes gravels containing not more than 2 per cent. of monazite—a product worth £28 per ton—can be prepared. The ultimate product exported contains 95 to 96 per cent. of monazite, and yields on an average 3·7 per cent. of thorium dioxide. It is loaded for export in sacks containing 60 kilogrammes. The cost of excavation, treatment, and transport to the nearest port is rarely less than 50, or more than 120, milreis—that is, from £2 10s. to £6; while the freight to Europe is about 12s. The total cost of placing a ton in Hamburg may be taken at from £3 10s. to £7. This includes all expenses except those of litigation, which are often considerable, and official dues and exactions. The average price of material of this quality in recent years has advanced from £20 to £28 per ton; and it has a tendency to rise. The price is often quoted at so much per unit per cent. of thoria (thorium dioxide) per ton of sand; and the greater the percentage of thoria the higher the value per unit per cent., as the cost of extraction of the oxide from rich monazitic sand is less than from poor material.

#### North and South Carolina.

In North and South Carolina, the sands are usually roughly concentrated by the farmers. The beds of the streams have now been exhausted, and it is mainly the adjoining alluvial deposits in the valley bottoms that are worked. The gneiss, the original source of the monazite, is decomposed to a considerable depth *in situ*, but it is not worked at present for the mineral. In a few cases, however, the soil and subsoil overlying the gneiss are brought down from the hillside to the streams to be washed.

The monazite-bearing sands are concentrated in sluice-boxes 8 feet long, 20 inches wide, and 20 inches deep. A perforated iron plate is fixed at the upper end of the box on to which the gravel is charged by one man, while another works the contents up and down with a "gravel fork" or perforated shovel in a current of water, so as to float off the lighter sand. At the end of the day the monazite is collected and dried in the sun or on sheet-iron over a fire. Magnetite is then removed by means of a large hand magnet. A concentrated sand containing from 65 to 70 per cent. of monazite is considered of good quality, and the separation of 40 to 70 lbs. of material of this character is a good day's work. The impurities include zircon, ilmenite, rutile, brookite, corundum, and garnet. Richer material may be obtained by more thorough washing; but in such a case a lower box, or even more than one, must be employed to save the monazite carried over. By these means material containing 85 per cent. of monazite is obtained, which may be again treated by winnowing in a dry state; but this lengthy treatment involves considerable expense, as well as loss of monazite.

Recently, concentrating mills have been established. In some, if not all, of these, separation is carried on by electro-magnetic methods. In some cases, the Wetherill electro-magnetic separator is employed. The finer material containing the monazite is separated from the dried concentrate by some form of sieve, and allowed to pass over a revolving drum, and is thus scattered evenly over an 18-inch belt. This passes under four electro-magnets which have small belts under the poles which carry the material attracted out of the magnetic field. The first magnet, which has the weakest field, removes only the ilmenite and part of the garnet; the magnetite having been previously extracted by hand magnets. The second removes the rest of the garnet, and the third and fourth the monazite.

The commercial value of the Carolina monazite is diminished by the size and hardness of the crystals, which render them difficult to dissolve in acids. It is necessary to reduce them to powder before treatment.

#### Production of Monazite.

The United States produces about 200 tons of monazite per annum, and the Prado deposits of Brazil about 1600 tons per annum. The total output of the remainder of Brazil is not known. It may, perhaps, amount to another 2000 tons; but these deposits, unlike those of Prado, are, as has been stated, not renewed indefinitely. The total amount of monazite in Brazilian deposits of this class, containing over 15 per cent. of the mineral, is estimated at 16,000 tons.

#### Extraction of Heavy Minerals from Ceylon Sands.

With regard to the working of the Ceylon sands containing thorianite, thorite, and other heavy minerals, everything depends on the local conditions. Except near the sea coast, there are probably few rivers which are deep enough and contain sufficiently extensive alluvium to make it desirable to employ floating dredges. Probably the contents of the river beds could be best reached by diverting the water in the dry season, and removing the payable gravel, which could either be concentrated by washing at once, or, if sufficient water were not then available, accumulated in heaps until the rainy season. The alluvial material in the valley bottoms could probably also be more economically mined in the dry weather, as there would be less water to deal with. The work of excavation should be carried out on a large scale, in an open quarry. In most cases there would be, no doubt, an over burden to be removed before the valuable deposits below could be dealt with.

If, as is probably the case, the grains in the material to be treated vary considerably in size, it should first be sized by dry sorting. It should then be carefully washed in a couple of sluices arranged in series one below the other. This should suffice to give a product that is practically free from quartz and felspar and other light material. More complicated machinery would require constant adjustment according to the minerals present and their size, and would require skilled labour and highly-paid superintendence. The materials worth collecting in different sands are often very close in their specific gravity to minerals such as zircon and ilmenite, for which there is little demand. It will be better, therefore, after having obtained a comparatively clean, heavy sand, to resort to magnetic methods of separation. Magnetite is easily removed by permanent magnets, ilmenite can be raised by electro-magnets in fields of moderate strength, and fergusonite and garnet in rather stronger fields. The material left will be composed mainly of zircon, thorianite, thorite, rutile, tinstone, gold, and various rare minerals. From this the thorite and rutile can be separated if the strength of the field is still further increased, though it will not be easy to effect complete separation. After the magnetic treatment, it will be much easier to carry out still further separation by washing in sluices, moving tables, or tubular hydraulic classifiers.

A tubular classifier has recently been devised in which the water passes upwards between two concentric cylinders. Sized

material is fed into a hopper, and ultimately passes outwards through a horizontal groove in the inner cylinder into the upward current. Here the heavy grains sink against the current and pass down into a locked receptacle, while the lighter material rises with the water. In a large installation several of these separators are employed; the material being graded according to size in trommels, so that each size is dealt with in a special separator, in which the current is so adjusted that separation will take place at the density required. A simple form of this apparatus might usefully be employed for the final treatment of magnetically separated material.

The possibility of finding the thorianite or other valuable minerals *in situ* in decomposed rock which can be easily worked should not be neglected, though the prospects of success are seriously diminished by the fact that these minerals are usually found in ancient alluvium laid down by former streams, and that since it was deposited immense quantities of rock have been removed from the surface of the country by subaërial agencies. Finally, it must not be forgotten that heavy minerals containing thoria or other valuable material may be found in a finely-divided state in the alluvium of the lower courses of the rivers and the adjoining flats, as well as in the sands of the sea shore. Too much stress cannot be laid on the importance of systematic work, adequate machinery, and skilled superintendence in the exploitation of these heavy minerals, which vary so much in their characters, contents, and value.

### Monazitic Sand from Queensland.

The "Bulletin" also gives particulars of an analysis of a consignment of fine sand, weighing about 1 cwt., recently received from the Agent-General for Queensland, who stated that the material had been submitted by the Department of Mines of Queensland in order that its chemical composition might be determined, and the commercial value, if any, of the constituent minerals ascertained.

A preliminary examination of the material showed that it contained only a small proportion of heavy minerals likely to be of commercial value. The crude sand was therefore concentrated by the action of running water, and in this way a considerable amount of quartz, felspar, biotite-mica, actinolite, and minute rock fragments of no commercial value, was removed; while a residue, consisting principally of heavy minerals, amounting to about 21 per cent. by weight of the whole, was obtained. This concentrated material was then analyzed in the Scientific and Technical Department of the Institute, and gave the following results:—

| | Per Cent. |
|---|---|
| Silica ($SiO_2$) | 7·59 |
| Titanium oxide ($TiO_2$) | 44·59 |
| Zirconium oxide ($ZrO_2$) | 1·06 |
| Thorium oxide, thoria ($ThO_2$) | 0·23 |
| Alumina ($Al_2O_3$) | 1·46 |
| Yttria ($Y_2O_3$) | 0·10 |
| Ferric oxide ($Fe_2O_3$) | 1·24 |
| Ferrous oxide (FeO) | 36·38 |
| Manganous oxide (MnO) | 2·79 |
| Copper oxide (CuO) | 0·05 |
| Lime (CaO) | 0·79 |
| Magnesia (MgO) | 1·16 |
| Cerous oxide (CeO) | 0·46 |
| Phosphoric acid ($P_2O_5$) | 0·41 |
| Niobic oxide ($Nb_2O_5$), tantalic oxide ($Ta_2O_5$ | 0·78 |
| Moisture | 0·80 |

These results indicated the presence of the minerals ilmenite, quartz, garnet, zircon, magnetite, monazite, and possibly tantalite in the "concentrate;" and this was confirmed by microscopical examination. The proximate composition of the concentrated mineral may, therefore, be taken as—

| | Per Cent. |
|---|---|
| Ilmenite ([Fe, Mn, Mg]O, $TiO_2$) | 84·0 |
| Magnetite ($Fe_3O_4$) | 1·8 |
| Zircon ($ZrO_2$,$SiO_2$) | 1·4 |
| Quartz ($SiO_2$) | 4·4 |
| Garnet and other silicates containing alumina, lime, and magnesia | 5·0 |
| Monazite* | 1·2 |
| Tantalite | 0·9 |
| Moisture | 0·8 |

* A portion of the thoria may be present as thorite (thorium silicate).

The amount of thoria present in the "concentrate" is only 0·23 per cent., and in the crude mineral 0·05 per cent.; and the proportion of cerium oxide is 0·46 per cent. in the "concentrate," and 0·10 per cent. in the original sand.

Material as poor in these oxides as the present sample, or even the "concentrate" prepared from it at the Imperial Institute, would probably not prove remunerative to work under existing conditions. At the present time, the value of the "concentrate" as a source of thoria would probably not exceed £2 10s. per ton, assuming that it would pay to extract thoria from such material. The percentage of thoria could doubtless be increased by removing the magnetite and ilmenite by magnetic separators; but it would seem hopeless to attempt to compete by this means with the Brazilian monazitic sands, which constitute at present the principal commercial source of thoria. These, in the concentrated form in which they are exported, yield about 4 per cent. of this oxide. Further, the new Ceylon mineral (thorianite) contains about 70 per cent. of thoria, and therefore is of greater value than any other source of thoria.

The percentage of cerium oxide in the Queensland sand is double that of the thorium oxide; but the demand for the former is very limited, since, in the construction of mantles for incandescent gas lighting, only 1 per cent. of ceria is used to about 99 per cent. of thoria. Titanium oxide is present in the concentrate to the amount of 44·59 per cent., corresponding to 9·27 per cent. of the crude sands. Titanium is but little employed in the arts. It forms useful alloys with iron and steel; and the carbide has been tried with some success in the manufacture of filaments for electric glow lamps.

The only other constituent of the sand likely to possess commercial value is the tantalum. Recent experiments have shown that this metal can be used as a filament in electric glow lamps, and such lamps are now on the market. The "concentrate" prepared from the Queensland sand contained, however, only 0·78 per cent. of tantalic and niobic oxides; so that it is improbable this material could be used as a commercial source of tantalum in competition with the other richer tantalum minerals available.

No precise information was supplied with the consignment regarding the locality in which the sand was found, nor the conditions under which it occurs. It is impossible, therefore, to say whether by further search a richer sand is likely to be obtained; but it may be suggested that it would be worth while to continue explorations in the same district, in the hope of securing richer material.

## ANALYSES OF WATER ACCOUNTS.

When a publication has attained its majority, and has gone on a few years towards its jubilee, it may fairly be assumed that it has justified its existence. Circumstances may have changed in the course of a quarter of a century, and have called for some modification of the original plan of the projectors; but when this has widened the scope of the publication, and rendered it more generally useful to the class for whom it is primarily intended, it must, we think, be taken as evidence of a desire on the part of those responsible for its production to ensure for it in the future a continuance of the appreciation it has secured for itself in the past. These remarks, it seems to us, are peculiarly applicable to the well-known "Analysis of Water Accounts" issued annually by Messrs. Wood, Drew, and Co., which, as will by seen from an announcement appearing elsewhere, has now reached its twenty-fifth year of publication.* Originally, as many of our readers may remember, the "Analysis" was confined to the accounts of the London Water Companies; but a few years ago, by the courtesy of the Corporations of Edinburgh, Glasgow, and Manchester, the compilers were able to include those relating to the water undertakings in the cities named. Last year a still further improvement was made by the inclusion of some of the principal Provincial undertakings; and in the issue now under notice their number is increased by four—viz., Cardiff, Derby, Halifax, and Portsmouth. Apart from this, the work contains several new features to which it may be of interest to direct our readers' attention.

Taking first the Metropolitan Water Supply, the compilers explain in their preface that they were not in a position to furnish figures in relation to the accounts of the Water Board; but they express the hope that they may be able to include an analysis next year. They were able, however, from the returns of the Official Water Examiner (Mr. Charles Perrin, M.Inst.C.E.), to continue the tables dealing with the quantity of water supplied in each of the "districts" which have now taken the place of the areas of the Water Companies. The three succeeding tables—dealing respectively with the estimated population and the total quantity of water supplied, the average daily supply, the number of houses served, the extent of the constant supply, and other matters—are also continuations. These, however, are followed by an entirely new table, showing the consideration paid for the transfer of the Companies' undertakings to the Water Board, with calculations per million and per thousand gallons of water supplied. This table, which consists of seventeen columns, is highly instructive, especially when examined with the aid of the notes appended to it. It may be divided into five groups, showing the amount of compensation paid by the Board, the loan and debenture capital taken over, the total consideration, the interest charge, and the dividend and interest charge calculated upon the old basis. The compilers show that £42,854,148 was the amount of the awards and of the loan and debenture capital taken over, and that the corresponding amount in the 3 per cent. stock (at £109 10s. per £100) is £46,931,050, or £589·36 per million gallons of water. The interest on this comes to £1,407,932, while the dividend and interest on the old basis would have been £1,463,915. The compilers are careful to explain that this table, which is worthy of attentive study, does not show the compensation paid to the Directors and other officials or the expenses of the arbitration. The next table (a continuation from the preceding year's "Analysis") gives the rates of supply.

We now come to the accounts of the Provincial water undertakings—twenty-one in number. The first three tables furnish

* "Statement Relating to the Undertakings of the Metropolitan Water Companies, and an Analysis of the Accounts of Some of the Principal Provincial Water Undertakings, for the Year 1904-5." Compiled by Wood, Drew, and Co., Chartered Accountants. London: Walter King; 1905.

similar information to that contained in the corresponding tables in previous "Analyses," but, of course, with the four additional undertakings already mentioned. In the present edition, however, they occupy a larger area, as the lines have been opened, which adds considerably to the clearness. The new feature—and it is a valuable one—in this portion of the book is found in the table showing the rates of supply. In the "Analysis" for the year 1903-4, the rates were contained on a single page; whereas in the present edition they extend over four pages. On the first are given the annual domestic charges, including one closet, at rateable values ranging from £11 to £201; on the second is found the charge including two closets and a bath; and on the third, the quarterly charge per 1000 gallons for water supplied by meter—the quantities ranging from 11,000 to 5,001,000 gallons. These tables are fully noted; and the figures show at a glance the different rates charged in the towns named. On the fourth page of this group are given particulars in regard to the method of charging shop premises which are used partly for domestic purposes, the charge for water employed for flushing and street sprinkling, and the public water-rate, in the various towns selected.

It will thus be seen that the new issue of the "Analysis" contains many features which enhance its value in comparison with its predecessors. Its compilers are known by name to most managers of water undertakings; and their long experience in dealing with the accounts of this industry and the allied one of gas supply qualifies them in a very special manner for the compilation of such a work as that with which they have so long been associated.

### The London and Southern District Junior Gas Association.

About forty members availed themselves of the opportunity of inspecting the works of the Buhlmann Incandescent Syndicate on Saturday. The party were received by the General Manager, Mr. J. H. Sheldrake, who personally conducted them throughout the inspection, and through whose kindness the works were kept running during the afternoon, in order that the complete process of the manufacture of the incandescent mantle might be seen. At the conclusion of the inspection, the President (Mr. W. Grafton) said it was with pleasure that he proposed a vote of thanks to the Directors and the General Manager for their kindness in allowing the members to visit the works, and to Mr. Sheldrake also for the trouble he had taken in explaining the points raised. Mr. R. H. Brown seconded the motion. Mr. W. J. Liberty, in supporting, pointed out to what extent the gas industry was indebted to the advent of the incandescent mantle. Mr. Sheldrake, in reply, said he was pleased to meet the members of the Association. They were doing their best to perfect the mantle; but its cost was increased owing to the action of the German Thorium Convention, whose breaking-up he predicted within twelve months. This, he said, would be welcomed by all concerned.

### Effect of Motor-Cars on Gas-Mains.

Our readers are doubtless aware that a Royal Commission is dealing with the subject of motor-cars. The proceedings of the Commission—the Chairman of which is Lord Selby—are being conducted in private; but they reached a stage last week which is specially interesting to all engaged in the gas industry. It may be remembered that, by an Order made last year, the Local Government Board sanctioned the use of cars of greatly increased weight, and permitted them to be driven at a much higher speed than previously. The effect of this on gas-mains has been very serious; and at the sitting of the Commission on Friday Mr. G. F. L. Foulger, the Chief Distributing Engineer of the Gaslight and Coke Company, gave some valuable evidence on this point. Among the other witnesses called were Mr. G. L. Gomme, the Clerk to the London County Council, and Mr. J. A. Steel, on behalf of the Highways Protection League. The preceding day, Mr. J. Ogden Hardicker was examined on behalf of the Urban District Councils' Association; and Mr. E. E. B. Newton and Mr. Norman Scorgie, the Borough Surveyors of Paddington and Hackney respectively, attended as representatives of the Metropolitan Borough Councils. Since the 10th of October, the Commission have had 27 sittings and examined 110 witnesses; and at the close of the inquiry last Friday the Commissioners adjourned till after Christmas. We believe it is not proposed to take any more evidence.

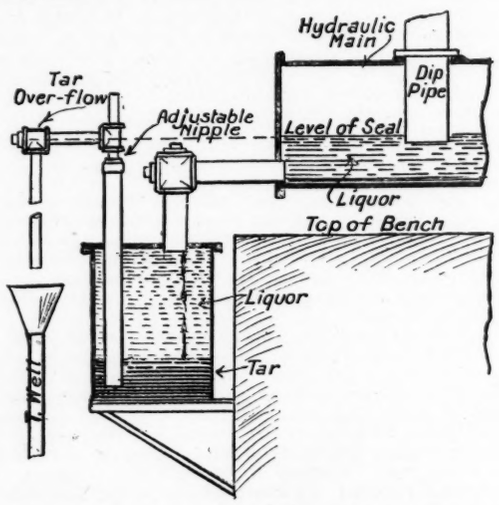
Dr. J. Kellett Smith, the Chairman of the Hoylake and West Kirby Gas and Water Company, whose death was announced in the "JOURNAL" for the 14th ult., left estate of the gross value of £68,200; the net personalty amounting to £46,329.

According to the French papers, Paris is getting alarmed at a possible shortage of coal. The consumption of this fuel increases; but, unfortunately, the production has a tendency to fall off. Curiously enough, the stock of coke at the gas-works is unusually low; being only about 825,000 bushels, compared with close upon 10,000,000 bushels, which has hitherto been customary. With coal and coke short, and nothing settled as to a continuation of the gas supply after the end of the year, the position is rather serious.

## PREVENTION OF NAPHTHALENE DEPOSITS.

### An American Suggestion.

In the number of the "American Gaslight Journal" for the 20th ult., Mr. F. C. Slade offered a few remarks on the ever-present question of naphthalene deposits, and made a suggestion for remedying them. He said in the course of his travels he had called upon a number of gas companies who were troubled with naphthalene, and also on others who had been so in the past. A little conversation with the latter companies brought out the fact that the same course of procedure had, in every case, in a general way, overcome the difficulty; and by a very simple process of reasoning the immediate cause was determined. He therefore came to the conclusion that the same procedure in any gas-works would remove the naphthalene trouble; and accordingly he submitted his ideas of the remedy which are shown in the accompanying diagram.




Accompanying the diagram were the following remarks: "If the gas is brought into intimate contact with the tar between the hydraulic main and the purifiers, naphthalene will be formed, and will crystallize out at the first point where the gas is suddenly chilled; and if the tar is removed from contact with the gas, and the gas is brought into intimate contact with the gas liquor, the formation of naphthalene will be prevented. The sketch shown herewith is designed to accomplish the removal of all the tar from the hydraulic main, and to retain, by displacement, the light oils and liquor, with an automatic overflow for carrying off the tar. Practically all the tar-valves on the market are designed to take the tar off the bottom of the main; but, notwithstanding this fact, the hydraulic main has a way of filling up with tar almost unknown to the superintendent."

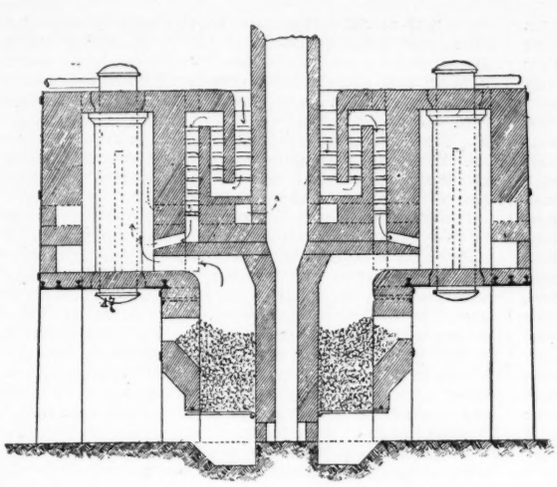
## VERTICAL RETORTS IN CYLINDRICAL SETTINGS.

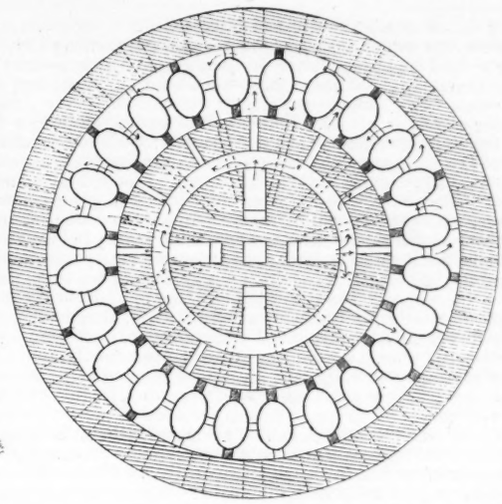
Upon the work of perfecting the vertical retort as a means of gas production has been centralized the attention of investigators in this line; and almost as a matter of course, they have been exercising themselves in so doing in adapting the present style of setting to the new conditions brought about by the change in the retort. Whether the investigators are right or wrong is not a matter for determination in any summary fashion; but from communications and drawings which we are pleased to have received from Herr W. Bäcker, of Budweis, Bohemia, we learn that the experimental work of this gentleman has brought him to the conclusion that the placing of vertical retorts in a cylindrical setting is the most expedient and correct form for various reasons. Consequently he has applied for a patent to cover his method of construction.

As translated from his communications, the reasons adduced by Herr Bäcker for his preference of the cylindrical style of setting are the following.

In the first place, there is an economy of ground space, for the circular beds only occupy 20·5 square feet per retort; and the bracing is easy and cheap to effect in an efficient manner, for only flat wrought-iron rings are required. A displacement or distortion of the setting as a whole is, he holds, impossible in the case of circular beds; and therefore serious cracks cannot be formed.

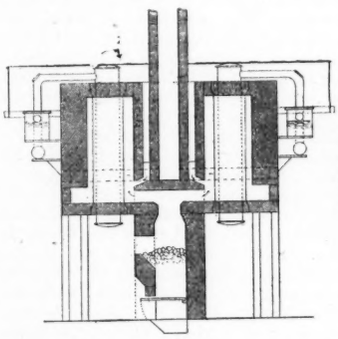
As each retort is fitted with its own tar-seal and dip-pipe, "the usual expensive and complicated hydraulic main" is not needed. Any single retort or part of the furnace can be isolated from the rest of the plant for repair or renewal; and therefore the setting can be worked with any number of retorts less than the whole number it contains. Self-sealing lids are not used at the lower extremities of the retorts. Herr Bäcker contends that they are,

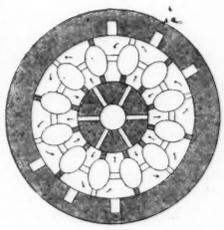




in fact, quite unsuitable for that position, because coal is liable to fall into their moving parts. Moreover, this coal is not carbonized; and its presence renders the coke unfit for certain applications, especially lime-burning. It is better, he advises, to put about 45 lbs. of coke into each retort before charging it with coal.

The setting is so arranged that the furnaces can be fired with coke hot from the retorts. The labour of attending upon the bed is much lighter than when vertical retorts are set in rectangular benches—much of the work being done from above, not from the top of the setting itself, but from a gallery about 2 feet below the top. The retorts are charged with the aid of a circular traveller above the setting.





Cylindrical settings can, the inventor states, be constructed to hold from 6 to 96 or even more retorts. A gas-works producing 35 million cubic feet per annum would require a bed of about 24 retorts—6 for use in summer, 18 in winter, and 6 for reserve. A bed of 96 retorts, arranged in two concentric rings of 48 each, has a diameter of 48 ft. 6 in., and its circumference is therefore 152 ft. 6 in. A rectangular setting of the same capacity would, he calculates, exhibit a perimeter of about 340 feet. "Hence the loss of heat by radiation would be twice as great with the rectangular bench."

Broadly speaking (Herr Bäcker argues), the radial method of arranging vertical retorts has a "great superiority" over the usual plan in the greater ease with which repairs or renewals can be carried out. "If a vertical retort breaks in a rectangular bed, the whole structure must be pulled down; and the rebuilding, when the contiguous beds are under fire, is a difficult operation, which injures the neighbouring benches." A single retort in a cylindrical setting can be renewed without affecting the others; and the entire bed can be rebuilt without any risk to the rest of the plant.

Some of the details of the Bäcker setting are shown in the accompanying drawings.

## Benzol and Toluol for Driving Motor-Cars.

With reference to the paragraph on this subject last week (p. 616), we find that in the course of the past year three articles, embodying the results of some investigations undertaken by Mr. F. H. Lees, F.I.C., F.C.S., on behalf of the "Autocar," appeared in that publication. The last article, in the number for the 6th of August, contained some details of an experimental run made from Southampton to London and back with various fuels, for comparison, by Mr. H. Parsons, of that town. The subject would, we believe, have been further investigated, had the tar trade shown any interest in it; but with the exception of Messrs. Read Holliday and Sons, Limited, of Huddersfield, the firms engaged in it appeared to be absolutely indifferent.

## HIGH-PRESSURE GAS DISTRIBUTION TO-DAY.

By H. L. Rice, of Aurora (Ill.).

**[A Paper read before the American Gaslight Association.]**

Some thirty years ago, in the Beckton Gas-Works, London, it was found that the two 48-inch lines into and through the City would not carry sufficient gas at full holder pressure, and pumping was resorted to. The pressure carried has increased slowly with the demand on the lines, until to-day it is reported as about 2 lbs. The gas so pumped passes partly into holders and partly into the low-pressure mains direct through governors. It is believed that this is the first authentic instance of the use, in distributing ordinary illuminating gas, of pressures higher than the few inches of water of common practice.

A gradual increase in pressures carried on main distributing lines followed a few years later in several American cities, under conditions of duress similar to those in London, without, however, developing any decided sentiment in favour of the innovation. A 24-inch line, 18,000 feet long, in New York City, and still in use, though never followed in that city by any similar pressure installation, dates from 1880, and delivers directly into the low-pressure mains. The pressure at the far end of this line is transmitted electrically to the pumping-station, and 26 to 30 inches, or about 1 lb., is carried on the line when required. Brookline, Pawtucket, Derby (for a short period about 1885), Philadelphia, Brooklyn, Kansas City, and Terre Haute (during the gas war), all found more pressure a necessity, and pumped to obtain it. A fan blower was installed in Milwaukee, at the Third Ward works, in 1895, as a safeguard, and found emergency service the first year through the breakage of the main river pipe to the west side. This and later emergency pumping in Milwaukee—first regarded as a necessary evil, and then as a good servant—has developed into the fine pressure-reinforcing system in use to-day.

Probably the first high-pressure line designed as such, where pressure was planned for, and not the result of, stress of circumstances, was laid in 1885, from Oakland (Cal.) across the narrow arm of the bay to Alameda. This line was a 4-inch, reduced to 2½ inches where submerged; and the gas was pumped with a rotary pump from Oakland under 10 lbs. pressure into the holder at Alameda, a distance of 8300 feet. Eight years later, an 8-inch cast-iron main was substituted, running 8 miles by a different route to the same holder terminus. A pressure of 5 lbs. supplied by a Roots exhauster, was used on this line, which, in addition to supplying the holder, reinforced two low-pressure districts through which it passed.

In 1890 gas was pumped under 10 lbs. pressure in Chicago, by a compressor, through an 8-inch wrought-iron line about 4½ miles long, from the Mutual Gas-Works to an outlying holder. From 1890 also dates the high-pressure distribution installation at Danbury (Conn.), well known through the prominence accorded it in Mr. Shelton's early articles and discussions on high pressure, and the first example of the use of a district regulator and of compression storage tanks in distributing artificial gas. Other installations prior to 1899, working as quietly as successfully, were the forcing lines from Long Branch to Red Bank and Elizabeth (N. J.) to Rahway, Gloversville to Johnstown (N. Y.), and Louisville (Ky.) between holders.

In 1899, at the meeting of the Western Gas Association, Mr Shelton read his first paper advocating the use of higher pressure in gas distribution.* By his keen analysis of the situation, his citation of work already accomplished, of natural gas practice, and other high-pressure work, he brought the subject for the first time prominently before the gas profession. This paper was followed by four others the next year, in which the line built from Phœnixville to Royersford (Pa.) was described. This line,

* See "Journal," Vol. LXXIV., p. 372; and Vol. LXXVI., p. 769.

feeding first a district holder and later a district regulator with the holder cut out, and also supplying customers along the line through individual regulators of natural gas pattern—another innovation in artificial gas supply—was from the start, and has since remained, a distinct success.

Under the spur of Mr. Shelton's energetic advocacy, a few other installations followed in Pennsylvania; while the establishment of two successful lines near Chicago gave an impetus which was followed by several systems in Illinois. General acceptance of high pressure was, nevertheless, slow. Rapid progress was, however, made in 1902; and recognition of the value of high-pressure work became general the following year. In the President's address before the Ohio Association in the spring of 1903 is found the first official recognition in any Association President's address of the drift towards high pressure. Mr. Butterworth said, in his "Progress Department" that year, that it is "now demonstrated to be a mechanical and economical success;" and he stated that thirty systems were then in operation.

Such hesitancy as there was on the part of our engineers to accept high pressure was largely due, first, to a fear of its effect on candle power; and, secondly, to the lack of proper formulæ for high-pressure transmission. The mechanical difficulties, it was seen, could be overcome; and the successful transmission and distribution of natural gas were acknowledged. But the question, "Would it pay in the illuminating field?" remained, until routed by broader knowledge and demonstrated success.

Briefly reviewing thus the history of the inception of high-pressure transmission and distribution in our gas industry, it only remains to point out that, despite the early hesitating successes here and there in increasing pressure, despite the two earlier successful lines, one in the extreme East and one in the far West—successful, but unknown—high-pressure work as we know it to-day in America dates from the Phœnixville line of 1899. This also was the first line to dispense with any storage except the line itself, and to demonstrate that it was simple, economical, and practicable to lay a comparatively small pipe, put sufficient force behind it, and serve customers with perfect satisfaction at the far end and along the way. In reply to an inquiry as to the late history of this installation, Mr. Shelton writes: "We have never been bothered or heard from it in any way. There has not been the slightest hesitation on the part of the Phœnixville line, or any of the high-pressure plants, as to their operation or delivering satisfactory results. I think it desirable to bring out the point of this continuous good work, even on the first plant."

High-pressure work to-day stands, solely on its own merits, an established factor in gas engineering. Its main recognized uses are: First, the transmission of relatively large volumes of gas to holders or to district governors serving outlying communities; secondly, the direct distribution of gas through relatively small pipes; and, thirdly, the reinforcement of low-pressure systems at selected points. In each case it is the marked lessening of investment outlay that commends high pressure, and often the concentration of interest which it promotes. In transmission work low pressure is clearly outdistanced; in distribution, large areas are profitably served where low pressure costs would be prohibitive; while in reinforcing work, such large outlays have been saved by the recognition of the new principle, that it may safely be said that every large gas undertaking in this country is to-day keenly interested in the possibilities of this phase of high-pressure distribution.

At the last meeting of the Ohio Gaslight Association, a notable paper on long-distance transmission was read by a natural-gas engineer—the first contribution to our engineering councils, as far as the writer is informed, from the natural gas industry;* and it is well that those who have in common this problem of the economical transmission and distribution of gas under pressure should thus come together for its proper solution and the standardization of its engineering practice. Natural gas work is far older in this field; while the stricter limits of our practice have led to the solution by our engineers of many problems previously unstudied. Our debt to natural-gas practice must be freely acknowledged, and we may still learn from its successes. In compression work, our practice has stopped at the limit of about 50 lbs. pressure. A few instances of higher pressure are recorded, notably in California. The general average is about 30 lbs. for cross country and town distribution work; the work in the larger cities being confined to reinforcing pressure of 5 lbs. and less. Two-stage compression, economical as pressure rises above 60 lbs., has not been necessary as yet; and simple straight-line steam-driven compressors are most in favour, with a few of the more economical duplex type, and a few gas-engine and electric-driven installations reported. Fan blowers are successfully used for the lighter boosting pressures; and positive blowers are economically employed in higher work up to 5 lbs. The machinery used is generally in duplicate, and is so simple in action that the complete absence of failures or working troubles is not remarkable. Compression costs are variously reported at 2 c. and under. A single-stage compressor, delivering at 30 lbs., requires theoretically about 1·35-horse power per 1000 cubic feet of gas compressed per hour; to which must be added friction and clearance losses. The actual force required in compressing 10,000 cubic feet of gas per hour with a straight-line steam-driven compressor, located at Aurora (Ill.), and calculated from indicator cards, is, for 30 lbs. compression, 17-horse power, or 1·7-horse power per 1000 cubic feet. Noting for the moment that little more power is required in compressing the second stage from 50 to 300 lbs. gauge pressure than the first from 0 to 50 lbs., results actually secured in natural-gas practice of 4-horse power for 300 lbs. compression are not incomprehensible. With well-designed compressing stations, compression costs in our present practice may easily be under 1 c. per 1000 cubic feet, as claimed in many instances.

The problem of moisture removal has been satisfactorily solved by the application of carefully designed separators. The baffle-plate tanks designed by Mr. Goodnow and installed, one at his Waukegan station and another 500 feet out on the line, have done the work expected of them; and all trouble from ice has ceased in the North Shore lines. As the test of last winter was severe, with ice reported from at least one neighbouring line not so well protected, this cessation of trouble in the system noted is reasonably convincing. Condensation troubles reported from other points can doubtless be successfully met in this manner, and in pressure systems drips already little used are destined to become things of the past.

No satisfactory method of measuring the gas delivered by compressors has yet been reported. Counters have proved unreliable, as slipping and efficiency vary; and proportional high-pressure meters can only be accurate, if at all, at constant pressure. Measuring the gas delivered to the compressor station is practicable; but, except in plants devoted solely to high-pressure distribution, it involves a considerable increase in the investment. The use of a small direct high-pressure meter at hours of minimum consumption, as a daily check on the pipe-line condition and compressor efficiency will shortly receive a trial.

For the carriage of gas at pressures not exceeding 5 lbs., cast-iron pipe is successfully used, and most favourably regarded. It has also in a few instances been used at higher pressures, and specially-designed joints are on the market for this work. Cast-iron lines are also being designed, to be connected with couplings of the Dresser type—a style of connection which is attracting attention in low-pressure work also. Universal pipe is being used on a high-pressure reinforcing main at St. Paul (Minn.), now under process of construction. For pressures of over 5 lbs., however, screw-joint pipe of wrought iron or mild steel is most generally employed. In sizes of 8 inches and upwards, certain natural-gas engineers prefer couplings of the Dresser type throughout in place of screw-joints, on the ground of greater efficiency and more economy in laying. In the long screw-joint lines, expansion sleeves are provided about every 500 feet, and valves are inserted at intervals of perhaps half-a-mile for the isolation and repair of breaks. The history of the cross-country lines has, however, been one of almost entire freedom from breaks or serious leaks. Electrolysis has been reported from a few installations, and is generally thought more to be feared in wrought-iron and steel than in cast-iron lines. This trouble in the North Shore line has been successfully overcome by insulating the pipe with 10-foot sections of enamel pipe inserted at intervals; while on a new line which has just been laid by the North Shore Company, in a district of somewhat weaker currents, Dresser insulating couplings have been laid every 200 feet as an experiment.

The cost of laying cross-country lines has been brought very low by careful division of the work, and in spite of the adverse circumstance of location often far from a base of supply. Ditching is started by a plough making a deep furrow, and filling is done with a scraper. Pipes are laid in sections, and afterwards coupled by the expansion sleeves; and several gangs are employed in rapid work. On one 8-inch line laid last fall, three pipe-gangs of 12 men each, in a working day of only seven hours, averaged 4500 feet of pipe screwed together. This did not include testing or coating. The testing of these lines is done preferably with a small compressor operated by a gasoline engine or some convenient farm traction-engine. Electric motors have been employed where inter-urban street car-lines were within reach. Air pressures of 70 lbs. to 80 lbs. are satisfactory for testing; and soapsuds is universally employed. Where leaks are found which cannot be repaired by tightening, the coupling clamps of the Dresser type are employed. In a recent long run of 6-inch and 8-inch pipe, these clamps averaged one to every 15 joints. They are simple and effective, and are believed to be lasting.

High-pressure lines and distributing systems, properly laid, should be free from leakage; and if properly protected from earth corrosion, they should, in the absence of accidental causes, remain so. The importance of this subject of proper protection has been fully realized; and the best low-pressure practice has been brought to its solution. No particular coating has as yet won general acceptance; and several new preparations and methods are suggested, the value of which time alone can determine. No doubt the future will tell this story for high pressure more truly than the past, with the systems new, and inevitably with the detection of faults, and the consequent further improvement of methods.

In view of the fact that fear of loss of candle power was one of the principal factors in the slow acceptance of high pressure for manufactured gas, it is remarkable that full information should still be lacking on this phase of the subject. We know in general that the gas so far delivered under pressure has been uniformly satisfactory, and, roughly speaking, not appreciably

* See "JOURNAL," Vol. XC., p. 722.

depreciated in candle power or heat units; but for accurate figures we have thus far only three sets of tests. Those of Mr. Roberts, in 1899, showed no loss in candle power in gas pumped at pressures up to 50 inches, or a little less than 2 lbs. Those at Newton (Mass.), in 1903, showed a gain in candle power at 5 lbs. compression, but very considerable losses at 10, 20, and 30 lbs. The figures in these tests do not check well, and the tests covered compression only, and not transmission. Finally, we have the report of a Research Committee before the Ohio Association this year, that "the loss in candle power in compressing coal gas up to the actual pressure of 25 lbs. has been 0·3 of a candle, and water gas within 1½ candles; or an average of about 0·9 candle loss." This report covered six months' daily tests, made at the compressor station with each kind of gas. Tests at pressures above 30 lbs. are entirely lacking; and no experiments covering the effect of compression on heat units are yet reported. It should be pointed out also that comparative tests both of candle power and heat units at the delivery-point of high-pressure gas-lines are as necessary as those at the compressor station, if full and accurate knowledge is to be obtained. If it can be shown that, as the capacity of present pressure lines is reached, or as new lines have to be laid out, net economy in all other factors points to increased initial pressure, the importance of full and careful investigation will be at once indicated.

This brings me to the question of the flow of gas in pipes—a subject which has received far more careful attention than that of candle power and heat units. The early discussions show considerable groping in the dark as to the probable form of the high-pressure formula, with openly expressed doubts as to the efficiency of increased pressures. According to the low-pressure formula with which we have long been familiar, delivery increases only with the square root of the pressure; and in view of the relatively high value of diameter, the economy of such a method of increasing flow would be seriously open to question. The high-pressure formula, as finally developed and in present use, is, however, of radically different structure as to indicated pressure effect—a point which the writer desires to bring out clearly for consideration. This formula, not to consider refinements beyond the limits of our practical gas practice, is—

$$Q = C\sqrt{\frac{D^5 (P_1^2 - P_2^2)}{L\ g}}$$

where L is the length in miles and P the absolute pressure. The Pittsburgh formula, $g = 6/10$, has $C = 47{\cdot}5$. Robinson's formula has $C = 48{\cdot}4$—a difference less than practical variations in pipe diameters. Coxe's formula, from which the high-pressure computer is compiled, has $C = 41{\cdot}3$; while Oliphant employs a varying factor, which for 1-inch pipe is 42, and for 10-inch is about 49·9. Taking $g = 1$, we have C in the Pittsburgh formula changed to 36·8, which corresponds exactly with a well-known, air-delivery formula, as corrected by practical results. The writer concludes that, as far as our information goes at present, we are safe in using the Pittsburgh formula for pressures of 3 lbs. and upwards. Deliveries will probably somewhat exceed the calculated amount on straight runs of pipe as the pressures rise; while with crooked lines the excess will about balance the increasing resistance of the bends.

In examining the character of this formula it is at once seen that, as the initial pressure becomes relatively large compared with the final pressure, the amount delivered increases more and more in exact ratio with the pressure. Through 1 mile of 4-inch pipe discharging at atmospheric pressure, the theoretical quantity which will be delivered per hour is as follows:

*Gauge Pressure.*

| | | | |
|---|---|---|---|
| At 5 lbs. . . . | 20,064 cub. ft. | At 30 lbs. . . . | 64,448 cub. ft. |
| ,, 10 ,, . . . | 30,400 ,, | ,, 50 ,, . . . | 96,216 ,, |
| ,, 15 ,, . . . | 39,520 ,, | ,, 100 ,, . . . | 173,280 ,, |
| ,, 20 ,, . . . | 48,032 ,, | ,, 200 ,, . . . | 326,040 ,, |
| ,, 25 ,, . . . | 56,392 ,, | ,, 300 ,, . . . | 478,344 ,, |

If, for convenience, we speak of amounts delivered in exact ratio to the pressure applied as 100 per cent. efficiency, it is seen that though in an increase from 5 lbs. to 10 lbs. initial pressure we obtain only 76 per cent. efficiency, in increasing from 25 lbs. to 50 lbs. we obtain 85 per cent., between 50 lbs. and 100 lbs. 90 per cent., and in an increase from 200 lbs. to 300 lbs. 98 per cent. efficiency. An earlier understanding as to the effect of pressure on delivery would have materially hastened the general acceptance of high-pressure work; and the facts should be kept clearly in mind in considering its further possibilities.

As high-pressure lines or distributing systems not connected with storage holders approach their capacity at peak load with an initial pressure which it is not desired to exceed, the question of proper storage will become important. The majority of the lines already built have not yet had to face this question, for with large excess of capacity the peak load has been cared for by expansion in the line and additional pressure. Every high-pressure line is a storage reservoir, with its peak load efficiency as such gradually decreasing with the distance from the point of delivery. Compression storage placed at the beginning of the line adds capacity storage to the line at the most disadvantageous point; and it is not clear why the owners of several plants, notably in California, have adopted this principle, and why, in addition, pressures are maintained in these tanks higher than are required and used in the lines. These tanks, so placed, add nothing to the peak capacity of the line, and provide no greater margin of safety of pressure supply than lies in sufficient duplication of machinery at the compressing stations. On the contrary, it seems clear they should be placed at the delivery-point; and so placed, and made a part of the line at the line pressure, compression storage is efficient and reliable.

It is conceivable, however, and an interesting possibility, that in a works of moderate size, devoted solely or in large measure to high-pressure work, it might be found advantageous to use compression tanks at relatively high pressure for the sole storage, or a needed increase in storage, of the works. But this would appeal solely as a works problem, and as related to the investment and maintenance cost of low-pressure works storage, and the relative cost of compression, and not affecting in any peculiar way the transmission of the gas to distant points. No such works storage as such is, however, known to the writer, and it is not probable that compression storage for works of any magnitude can ever compete with the present method. Compression storage at delivery points is in successful use on the North Shore of Chicago, where it gives perfect satisfaction. The tanks for this work hold 3000 cubic feet of free gas at 30 lbs. pressure, and cost in place approximately $400 each. This is a moderate cost per 1000 cubic feet stored for small storage; and should line pressures rise in the future, the cost of outlying storage of this nature could be brought quite low with the increased capacity afforded. Outlying compressors second-staging into outlying tanks, to increase their capacity, might be a possibility in particular installations, but could not generally be considered economically advantageous.

The three methods of distribution from high-pressure lines have already been indicated. Where low-pressure holders are used, the high-pressure problem is simply one of the transmission to the holder, and is in no way related to low-pressure distribution. Holders will continue to be used where this distribution is preferred, and where district storage is desired for peak load and safety of the local supply. They allow the greatest efficiency in pumping, and afford a maximum capacity to pumping lines, but their cost of maintenance is considerable, and they have the disadvantage of restoring moisture, and consequent frost trouble, to a dry gas. In moderate-sized undertakings, it seems evident, and especially so if pressures come to be carried higher, that the relative merits of low-pressure and high-pressure outlying storage will become a serious subject for investigation.

The second method of distributing high-pressure gas is that by which a district governor is interposed between the pressure line and the low-pressure system, and the principle is unchanged whether the entire supply is thus furnished or an existing supply reinforced. The advantages of belt line reinforcing under pressure are so obvious that they require no comment, and the subject is fully covered in the description of the St. Louis system which is made a part of this paper. For the sole supply to outlying territory where local low-pressure distribution is preferred, the high-pressure line and district governor form the cheapest installation that can be made. These district regulators, which are now made in almost every size of low-pressure delivery desired, are simple, certain of action, and give practically no trouble. They are preferably set in duplicate, with one side always in reserve, and have a large safety blow-off for emergencies. Their range action is wide, and those which have come under the writer's observation have operated between extreme limits of 1 lb. and 50 lbs. without any alteration of pressure on the low-pressure side. In an installation of this character, it is seen that the compressors must be run according to the demand, and that no reserve supply exists beyond the capacity of the line at the pressure of the moment, the efficiency of which has already been discussed. In most present lines, the capacity of the line itself is still relatively large, the pressure range is low, the compressors are not overtaxed at the maximum demand, and the peak loads are as yet quite easily met. Outlying compression storage, however, adds to any such installation flexibility and capacity, and adds them in small units at moderate cost as required.

The most marked increase in high-pressure work has been in the so-called direct systems, where all the distributing mains are under the line pressure, and can therefore be run with small pipe at a greatly reduced investment cost. Roughly speaking, and for the same percentage drop, a 1-inch high-pressure main compares with a 3-inch low-pressure, and a 2-inch high pressure with a 6-inch low-pressure, with the reserve margin of supply, however, in favour of high pressure. This system has been taken up with distinct success for towns and cities of moderate size, and for the outlying suburbs of larger towns. As yet it is not favoured in thickly settled communities and business centres, where the cost of street-main investment is of relatively less moment, and danger from sudden leakage of much greater concern. In many of our modern cities, the consumption per foot of main is too high over large areas to make it economical to attempt to supply under pressure; while, on the other hand, direct high pressure has opened up gas-consuming territory where the consumption per foot of main would be absolutely prohibitive to low pressure. In the middle ground, no clear line is fixed to-day. But high pressure is gradually invading the low-pressure field; and it may be noted that those engineers who started with district-governor systems are now installing high pressure direct in similar undertakings. These systems generally consist of from 2-inch to 1-inch mains; and the investment cost averages about one-third that of low-pressure distributing mains. The average service tap is ½ inch, and saddles with lead gaskets are used. Three-quarter

inch services are the rule; and a great advantage in high-pressure work is the length of service which can be run. Several makes of individual regulators are on the market which give a close regulation and cause practically no trouble.

Three distinct improvements, simplifying high-pressure distribution work, may be briefly noted: The simplest tapping-machine ever invented (it may be carried in one's pocket); a saddle which dispenses with the corporation cock, saving money, and adding strength; and a mercury seal at small cost, easily set up and certain in action. In high-pressure work, dead ends are not apparently harmful; and the Company with which the writer is connected are now running all their side streets with 1-inch main controlled by one corporation cock—all the services being taken off from tees. The smaller high-pressure mains are generally laid on top over the centre of the ditch, which can be cut very narrow. This allows a perfect job of second coating; and the pipe can be strung, tested, and recoated very rapidly. Mains and services need not be graded, as no condensation should be feared. The cost of high-pressure services is about the same as those used with low pressure. The saddles cost from 30 c. to 50 c., the regulators $2·85, the lock-cocks 40 c., and the safety seals 40 c., or a total special cost for high-pressure services of about $4, which is easily saved in the lesser cost of the pipe in services of any length. The gas supply on the low side is absolutely steady, and gives perfect satisfaction; and a ¾-inch high-pressure service affords a relatively large margin of quantity. Gas-engines may be fed from the same service as the lights, provided only a separate regulator is fixed. The safety-seals will easily take care of any defect in the regulators; while in case of blow-outs, the maximum quantity of gas which can pass the small-bore lock-cocks under 10 lbs. pressure is about 500 cubic feet per hour.

In connection with this paper, it was thought that a description of two high-pressure systems, which by their magnitude have attracted attention, would be of interest. There are, therefore, presented for your consideration the main details of the reinforcing system of the Laclede Gas Company and of the high-pressure distributing system of the Western United Gas and Electric Company. Mr. W. A. Baehr, the Engineer of the first-named Company, has prepared a description of the St. Louis system—a courtesy acknowledged by the writer, who presents it in its entirety.

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### Medium-Pressure Gas Distribution at St. Louis.

The Laclede Gas Company employ for their ordinary low-pressure distribution the same kind of system as is in general use in cities—viz., cast-iron pipe of various sizes, fed by district holders located at the most advantageous places obtainable. This low-pressure system is destined to conform to our ideal system of distribution, which is figured on the basis of a square mile of the heaviest district consumption in the city. The total quantity of gas we are able to store in holders amounts to 12,500,000 cubic feet. These holders take care of a large portion of the ordinary low-pressure distribution during day and night. However, it was found that in the heavy lighting and cooking hours, or during the peak load, these holders were not able to give satisfactory pressure in the distant part of their respective districts, except by raising the pressure at the holders extremely high. To remedy this in the way usually adopted in such cases, would mean that more district holders would have to be erected, or very large low-pressure mains run. To avoid this, and at the same time to secure a more satisfactory service by being able to instal outlets wherever we desired, and also taking into consideration the future development of the city, it was determined to put in a medium-pressure belt line of large diameter. For this purpose a 24-inch cast-iron pipe was adopted, and the pressure fixed at 5 lbs. per square inch.

The reasons for adopting cast-iron pipe and for fixing the pressure at 5 lbs. per square inch were as follows: Electrolysis is so severe in this city that the use of unprotected wrought or steel screw pipe was out of the question. Therefore cast-iron pipe had to be adopted; and we felt that 5 lbs. per square inch in such pipe was reasonably high. Furthermore, this pressure was limited by the pumping machinery; the efficiency of positive rotary blowers with gas dropping rapidly above about 5 lbs. Had we wished to adopt a higher pressure, of (say) 10 lbs. per square inch, it would have been necessary to put two blowers in series, or to use blowing-engines. With a still higher pressure, of about 20 lbs. per square inch or more, we should have been obliged to use compressors, which, with the large amount of gas to be dealt with, would have been a doubtful expedient.

This belt line when finished will form a complete belt around the city. The gas for this line is supplied from the storage holders, and forced into the line by means of positive rotary blowers, which are able to deliver gas against the pressure we fixed. Some are driven by steam-engines, and others by gas-engines. During the mornings and nights, or during the light loads, these lines act as pumping lines to fill the various district holders from the works; and during the hour of peak load the lines may be supplied from the two works and two holder stations.

The pumping plant at Station A consists of four positive rotary blowers, each having a capacity of 150,000 cubic feet per hour against a pressure of 5 lbs. Each unit is driven by means of a direct-connected simple steam-engine. Station B has one unit, with a capacity of 500,000 cubic feet per hour against a similar pressure, driven by a compound steam-engine by means of a belt, and one unit of 150,000 cubic feet per hour against 5 lbs., direct connected to a simple steam-engine. Station H has one unit of a capacity of 500,000 feet per hour against 5 lbs., driven by means of a direct-connected horizontal gas-engine. Station G has one unit with a capacity of 500,000 feet an hour against 5 lbs., driven by two vertical gas-engines through a chain of gears.

At points where the pressure in the low-distribution system was low, we installed manholes, having a connection to the 5-lb. medium-pressure distribution system or belt-line, and outlets into the low-pressure distribution system through suitable governors. Each one of these manholes contains, besides various valves, two diaphragm governors of the Johnson-Reynolds type, with extra heavy leather diaphragms. They are exceedingly sensitive, and can each pass about 200,000 cubic feet of gas per hour. Two governors are used in series for safety. Should one governor give out, or from some cause refuse to operate properly, the remaining governor would take up its full duty, and reduce the pressure from 5 lbs. to that desired in the low-distribution system, as both governors are designed to act singly or in series.

The manholes are built in the street. The walls are concrete, and the roofs are of I-beam construction, with expanded metal and concrete arches. The whole structure is waterproofed by means of several heavy coats of asphalte, which is applied on the outside of the walls of the manhole. They are lighted by electricity, and have a drain which is connected to the regular city sewer system. The entrance to the manholes is by means of an opening in the roof. The cast-iron manhole cover is counterbalanced, making it very easy to raise and close; and it has a self-locking device. The manholes are ventilated by running a 3-inch wrought-iron pipe from the upper part of the manhole to some convenient telegraph or lighting pole; the pipe extending up the pole for about 8 or 10 feet. We have had no trouble whatever with the 5-lb. system.

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### The High-Pressure Gas Distributing System of the Western United Gas and Electric Company.

One of the first projected high-pressure lines was the Fox River line of the Aurora (Ill.) Gaslight Company, running 12 miles north from Aurora, and supplying four towns. From this line, and the later and equally successful line of the La Grange (Ill.) Gas Company, has been developed the present extensive system of the Western United Gas and Electric Company, supplying 24 cities and towns west of Chicago, with a combined population of 140,000, and an extreme distance between centres of 52 miles. The later pipe-lines of this system have been planned with a view of establishing one large manufacturing station for the entire system at Joliet, which point has great advantages of location. At present there are four main gas-works connected with the pipe-line; while a fifth is a small works at Lockport, soon to be shut down.

The coal-gas plants at Joliet, Elgin, and La Grange pump their gas into the pipe-line, and the combination coal and water-gas plant at Aurora puts in or takes out from the line, according to the conditions of pressure. Here is seen the curious arrangement of one water-gas plant reinforcing as needed four coal-gas plants separated by many miles, allowing them all to be run at their maximum efficiency. Holder stations are maintained at Joliet, Aurora, Elgin, and La Grange, and district governors at Batavia, Geneva, St. Charles, Hinsdale, and Downers' Grove; while all the other towns are direct high pressure. With compressors pumping at the four extremes of the line, the pressure carried at present is moderate; averaging 15 lbs., with no marked drop at any point. The line has, however, been tested throughout at pressures of from 60 lbs. to 70 lbs.

Beginning at Joliet, the line runs 8-inch through Plainfield to the hamlet of Copenhagen, 16½ miles, where it branches 6-inch to Aurora, 7½ miles, and 6-inch to Downers' Grove, 12 miles. From Aurora the line runs 5-inch and 4-inch due north 23 miles to Elgin. From Downers' Grove it runs 4-inch east and north to the towns along the Burlington and North-Western Railroads. Extensions to Dundee, north from Elgin, and West Chicago, west from Wheaton, are under way; and a line will shortly be run from Joliet to Lockport.

There are 85 miles of high-pressure main pipe-line, 275 miles of low-pressure mains, and 50 miles of direct high-pressure mains in the system, serving 19,200 consumers, of which number one-sixth depend solely on the pipe-line. The gas consumption is now at the rate of 550 million cubic feet, to which the towns dependent on the line contribute their full share, though many of them are still in process of development as gas-consuming territory. The high consumption per head of these suburban towns may be briefly indicated. Hinsdale (district governor station, population 3100) contains about 600 houses, has 554 gas-meters, and consumes 15,750,000 cubic feet of gas per year. Western Springs (direct high-pressure station, population 750) contains 140 houses, has 126 meters, and consumes 3,430,000 cubic feet per year. As showing the possibilities of high-pressure work in small towns, we may note Plainfield, a farming town on the line (population 1000), with 190 possible consumers. It was piped high pressure this year, with 1-inch and ¾-inch mains radiating from the central trunk line, at a total cost of only $1290, and contains already 150 well-satisfied gas consumers.

The most interesting feature of this system is naturally the proposed concentration of manufacture, which will make all the consumers of the Company, except those in Joliet, dependent on the pipe-line. Starting with 50 lbs. pressure at Joliet, and allowing

only 10 lbs. drop to the branch at the end of the 8-inch line, it is easily figured, allowing for the relative low-pressure consumption of Joliet, that this would care for a daily output about 40 per cent. in excess of the present maximum. A drop of 10 lbs. more would carry into Aurora the entire relative consumption of Aurora, Elgin, and the Fox River towns, while the drop would be much less should the Elgin gas be carried by a different route in the future. Thus the margin of pressure is considerable, and no less so on the other branch, with, however, the necessity of re-pumping into Elgin by the present route, unless the initial pressure at Joliet is raised about 50 lbs. The several holder stations will be maintained, but further than this no plans for outlying storage have been considered. The existing water-gas plants and compressors at the outlying stations will be maintained for auxiliary supply if required.

Such, in brief, are the main details of this extensive plan soon to be carried to completion—a legitimate result of high-pressure development. The success of this plant, and of similar operations in New Jersey, will clearly point the way to the manufacturing economies of the future.

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In concluding a subject far too comprehensive to be adequately covered in a single paper, the writer will again call attention to the immediate need of definite knowledge as to the effect of higher compression on the candle power and heating value of manufactured coal and water gas, and more especially as to the heat units, as each year sees direct candle power of less importance to our consumers. Working with two or more stages in compression instead of one (the common practice in other pressure work) six times the pressure can be secured with about twice the horse power. Six times the pressure means five times the delivery. With economical engines and compressors, the steam cost of the additional horse power will be still further reduced in comparison with present installations. These are the every-day facts of the natural-gas engineer, who pumps his product at greatest economy at about 300 lbs. pressure. Standing as the advocate of nothing but the careful scientific investigation of the problem before us, the writer notes that the drift is already towards higher pressures than those we have been content with, and that concentration in our industry beckons the way.

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## THE MIDLAND JUNIOR GAS ENGINEERING ASSOCIATION.

A Meeting of this Association was held in Birmingham last Saturday—under the presidency of Mr. F. J. Bywater—when Mr. G. W. G. Tatam (of Saltley) read a paper on

### SOME PHYSICAL ASPECTS OF GAS MANUFACTURE.

After remarking that the greater the knowledge of the fundamental principles of any process, the better able was one to carry out this process in the best and most economical manner, the author said he proposed to treat each process of gas manufacture more or less in detail, and to bring forward some of the most important physical and chemical laws underlying them. He then proceeded as follows.

I would at this point refer you to two facts of great importance. First, that chemical actions can be of two kinds: Exothermic reactions—reactions in which heat is liberated, *e.g.*, $C + O_2 = CO_2$—and endothermic reactions—reactions in which heat is absorbed, *e.g.*, $C + H_2O = H_2 + CO$. Secondly, that the energy difference between two identical conditions of a system must be the same independently of the way by which the system is transferred from one condition to another. That is to say, that the complete combustion of carbon by oxygen liberates 14,500 B.T.U. whether the combustion proceeds in one phase or two. Thus in one phase—

$$C + O_2 = CO_2 + 14{,}500 \text{ B.T.U.};$$

and by two phases—

$$(1)\ C + O = CO + 4{,}000 \text{ B.T.U.}$$
$$(2)\ CO + O = CO_2 + 10{,}500 \text{ B.T.U.}$$

To proceed, by the term "combustion" we mean the interaction between oxygen and another substance, with the development of sensible heat. When considering producers, we are concerned only with coke as the substance combining with the oxygen to produce this heat. You are no doubt aware of the fact that the interaction between carbon and oxygen can take place in two forms. Thus—

$$(1)\quad C + O_2 = CO_2 + 14{,}500 \text{ B.T.U.} \quad = 1 \text{ lb. carbon.}$$
$$\left.\begin{array}{l}(2)\quad 2C + O_2 = 2CO + 8{,}000 \text{ B.T.U.}\\ (3)\quad 2CO + O_2 = 2CO_2 + 21{,}000 \text{ B.T.U.}\end{array}\right\} = \text{for 2 lbs. carbon.}$$

or in reaction (3) with the liberation of 10,500 B.T.U. per pound of carbon. Each is a true combustion in the fact that both reactions occur with the development of heat. It is essential, for the economic working of a present-day regenerative setting, that the last two reactions should be distinct, and each phase determined in a separate part of the setting. The reason for this being that to determine the reaction—

$$C + O_2 = CO_2$$

completely, it is found that twice the quantity of air theoretically necessary is required practically; and this with the obvious loss of heat. Moreover, the heating is purely local; whereas if the reaction is carried out in two distinct phases, the heating effect can be efficiently distributed over a large area.

Now, since it is so necessary, on economic grounds, that the two reactions—

$$2\,C + O_2 = 2\,CO$$
$$\text{and } 2\,CO + O_2 = 2\,CO_2$$

should take place separately, it is essential that we should know the precise conditions for their maintenance. It would appear at first sight that the mere restriction of air would determine the first equation. This is partially correct, but by no means the most important condition. Well, then, what are the conditions? The air enters the bottom of the producer, and there interacts with the carbon of the coke, producing $CO_2$ as per reaction (1). This, as it ascends through the mass of hot coke, is partially reduced to CO—thus, $CO_2 + C = 2\,CO$ (4) by interaction with carbon.

We will now consider the actual quantities of heat evolved, taking as the basis of calculation 1 lb. of carbon. A pound of carbon to $CO_2$ requires 2·6 lbs. of oxygen, or 11·85 lbs. of air, and evolves 14,500 B.T.U. and 3·6 lbs. of $CO_2$, or 12·85 lbs. of unused $CO_2$ and nitrogen. Now, this 3·6 lbs. of $CO_2$, in ascending the mass of hot coke, is gradually decomposed to 2·3 lbs. of CO, as per reaction (4)—that is, if the reaction is complete—and for this reaction 10,500 B.T.U. are required. So that our net heat evolved so far is 4000 B.T.U. only. Of course, theoretically 1·3 lbs. of oxygen will be evolved on dissociation, as per the following equation: $2\,CO_2 = 2\,CO + O_2$, which oxygen will combine with 1 lb. of O to form CO. Now, the whole object of these calculations has been for the purpose of demonstrating the fact that heat is required for the realization of the equation—

$$2\,CO_2 = 2\,CO + O_2$$

Let us convert our B.T.U. into the more understandable form of temperature. As before stated, our net evolution of heat for 1 lb. of carbon and 5·92 lbs. of air to 2 CO is 4000 B.T.U. The temperature of a mass depends on the specific heat of the mass, on the average specific heat of its constituents, and the total quantity of heat contained in the mass. Specific heat is the amount of heat required to raise a quantity of the substance through 1° of temperature, compared with the heat required to raise an equal quantity of water through 1° as inacting. The mass we have here to consider is that of the products of combustion—

2·3 lbs. of CO of specific heat = 0·248
4·59 lbs. of N of specific heat = 0·244

and the total quantity of heat developed is 4000 B.T.U. Therefore the theoretical temperature is—

$$\frac{\cdot 4000}{(2{\cdot}3 \times 0{\cdot}248)\ (4{\cdot}59 \times 0{\cdot}244)} = 2{\cdot}350^\circ \text{ Fahr. as the approximate temperature.}$$

The following figures, bearing upon the above subject, were obtained by M. Derval in *Etude sur les Gasogens au Coke*:—

| Temperature. | 1290° Fahr. | 1472° Fahr. | 1652° Fahr. | 1832° Fahr. | 2012° Fahr. |
|---|---|---|---|---|---|
| Composition: $CO_2$ % | 72·4 | 61·0 | 40·0 | 14·0 | 2·2 |
| Composition: CO % | 27·6 | 39·0 | 60·0 | 86·0 | 97·8 |

So that we see from the above that for every temperature there is a definite relation between the $CO_2$ and CO.

Now I think we have realized the important point of the argument—*i.e.*, that the temperature at which carbon is completely converted to CO is approximately 2350° Fahr. Since it is necessary to maintain this high temperature in our producers, we must consider the conditions under which they are worked at the present time, and endeavour to trace any particular against the realization of this temperature.

After a brief allusion to the method of working producers, in the course of which he referred to the use of steam or water for cooling the furnace-bars, the author said: We will now proceed to consider the action of this steam in the producers. Steam—that is, water vapour—is composed of $H_2$ and O. It is a definite chemical compound. Steam, in the presence of incandescent carbon, reacts in two ways—

$$(5)\ H_2O + C = CO + H_2$$
$$(6)\ 2\,H_2O + C = CO_2 + 2\,H_2$$

as in the case of $CO_2$ and CO, there will be a definite state of equilibrium for each temperature. Now, a chemical molecule can only be broken up either with the evolution of heat or the absorption of heat. In this case $H_2O = H_2 + O$ is endothermic; and the "heat toning" of this reaction

$$\left\{\begin{array}{l}H_2O = H_2 + O\\ O + C = CO\end{array}\right\}$$

is, for 1 lb. of water decomposed,

$$= \frac{61{,}500}{9} \text{ B.T.U.} = 6833 \text{ B.T.U.}$$

Also 0·8̇ lb. of oxygen reacts with 0·6̇6̇ lb. of carbon to form CO, with the evolution of $4000 \times 0{\cdot}6\dot{6} = 2666$ B.T.U.. Therefore the "heat toning" of the reaction

$$H_2O + C = CO + H_2 =$$
$$-\ 6833$$
$$+\ 2666$$
$$-\ 4167 \text{ B.T.U.}$$

That is, for every pound of water decomposed and reacting with the coke of the generator, we have withdrawn and rendered latent 4167 B.T.U. At a temperature of 1800° Fahr. the reaction is $C + H_2O = CO + H_2$, and at 1112° Fahr., $C + 2\,H_2O = CO_2 + 2\,H_2$. You will notice that I have not calculated any value for the reaction—

$$C + 2\,H_2O = CO_2 + 2\,H_2$$

because this reaction value must be the same in both cases; the final products being $H_2 + CO$. I think we have answered the question, What are the most important conditions for the development of a good producer gas? and may summarize. For the reaction $CO_2 + C = 2\,CO$, sufficient depth of fuel, and only sufficient, is to be used, the temperature of the fuel to be as near 2300° Fahr. as possible; and for the reaction $H_2O + C = CO + H_2$, water only sufficient to keep the bars cool, and radiation effect to be reduced to a minimum.

Now as to the effect of nitrogen on the temperature in the generator. Again taking 1 lb. of carbon as our basis, and combusting it to CO only, first with air, and then with air *minus* the nitrogen, 1 lb. of carbon to CO = 4000 B.T.U., and requires 1·333 lbs. of oxygen and—

4·592 lbs. of nitrogen
Combusting C with air, we obtain { 2·3 lbs. CO. / 4·59 „ $N_2$
„ C „ oxygen „ 2·3 lbs. CO.

Therefore, for air, the theoretical temperature will be—

$$\frac{4000 \text{ B.T.U.}}{(2{\cdot}3 \times 0{\cdot}248)\,(4{\cdot}59 \times 0{\cdot}244)} = 2350° \text{ Fahr.}$$

and for $O_2$—

$$\frac{400 \text{ B.T.U.}}{(2{\cdot}3 \times 0{\cdot}248)} = 6{\cdot}920° \text{ Fahr.}$$

So that the effect of nitrogen is to absorb—

$$0{\cdot}244 \times 4{\cdot}59 \times 2350 = 2632 \text{ B.T.U. per lb. of C.}$$

But this heat is not lost, because when it reaches the cooler parts of the system, it again gives it up. So that, except for lowering the temperature intensity, it has no effect at all on the total heat production.

It has long been recognized that our present methods of carbonization, notwithstanding somewhat elaborated recuperative measures and restricted combustion, are very far from efficient, as the following figures will clearly show. Taking the total heat generated as 100 per cent., the total heat consumed by carbonization of coal, carried off by hot coke and gas, is equivalent to 42 per cent. The heat carried away by waste gases is 40 per cent., and the loss of heat by radiation, heating bar, cooling water, loss in ashes and clinker, is 18 per cent. We have here only a 42 per cent. efficiency of the apparatus for the work it has to carry out. With present methods of retort-setting construction, I see no possible means of economically increasing this efficiency. We must look to some method of a generator type of apparatus, where the carbonization, instead of taking place by heat conduction through a first-class insulator, shall occur immediately above, and in contact with, the fuel. Of course, it immediately strikes one that, for present-day use, this is out of the question; but until it has been tried on lines favourable to the production of an illuminating gas, little more than a mere suggestion can be made.

We will now proceed to consider carbonization, commencing with the heat of formation and decomposition. I have pointed out that during chemical reactions there is either a positive or a negative heating effect. Take, for instance, the reaction—$C + O_2 = CO_2$, this takes place with an evolution of 14,500 B.T.U. Also the reaction—$C + O = CO$, evolving 4000 B.T.U. These quantities of heat I have previously termed "heats of combustion;" but while this statement is quite true, there is another statement equally correct. That is, there are "heats of formation" of $CO_2$ and CO respectively; and no matter by what means these compounds are obtained, the "heats of formation" are always the same. That is, if $CO_2$ is formed by any of the following reactions—

$$C + O_2 = CO_2$$
$$CH_4 + 2\,O_2 = CO_2 + 2\,H_2O$$
$$CaCO_3 + 2\,HCl = CO_2 + CaCl_2 + H_2O$$

the amount of heat due to the formation of $CO_2$ is constant for equal quantities of $CO_2$ produced. Take the reverse case—that is, the realization of the reaction $CO_2 = C + O_2$. We have seen that, to break down $CO_2$ to CO and O, can only be done by an expenditure of heat amounting to 10,500 B.T.U.; and it is also found that to break down the CO to C and O requires the expenditure of a further 4000 B.T.U. So that to fully realize the equation—

$$CO_2 = CO + O = C + O_2$$

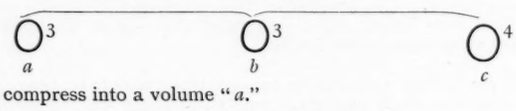
requires 14,500 B.T.U., a quantity equal to the heat required for formation. That is, the heat required for the production and decomposition of $CO_2$ is the same, but the effect is opposite—*i.e.*, on formation heat is evolved; and, on decomposition, heat is absorbed.

I will now deal with the subject of a partial pressure. You are well aware that gases have a tendency to occupy the greatest amount of space; and the result of this tendency is to create a pressure in the confining vessel. Also that gases are characterized by unlimited reciprocal permeability—*i.e.*, gases quite unlike in composition and quantity will, when mixed, become a homogeneous phase. It was found experimentally that for all true gases (within limits) the volume occupied was inversely proportional to the pressure, PV being constant, or that the pressure of a gas was proportional to its concentration. With knowledge of these facts, we are in a position to state the law of partial pressure. The total pressure exerted by a gas on the area enclosing it is equal to the sum of the pressures each gas would exert separately if expanded to the same volume. Therefore, for a mixture of gases, the total volume V would be the same for each, but the total pressure P would be the sum of $p_1 + p_2 + p_3 - pa$. Therefore—

$V\ (p_1 + p_2 + p_3 - pa) = PV$. $V$ = the volume of each gas.

Take the following as an example:—

Mix 3 volumes of $a$ at 760 mm. pressure
and 3 „ $b$ „ 760 „ „
and 4 „ $c$ „ 760 „ „




and compress into a volume "$a$."

Then $Pa\,Va + Pb\,Vb + Pc\,Vc = PV$
$= Va\,(760 + 760 + 1013) = 7600\ PV$
$= 3\,(760 + 760 + 1013)$
$= 3\,(= 2533) = 7600\ PV$

expand into volume "$c$."

$Vc\,(Pc + Pa + Pb)$
$= 4\,(760 + 570 + 570)$
$= 4\,(= 1900) = 7600 = PV.$

Therefore we see that under equal conditions the partial pressure is proportional to the volume of each gas before mixing for equal pressure. We may deduce from the above that by mixing two gases together at constant pressure, the partial pressure of each is reduced.

By combining the laws of partial pressure and mass reaction, and having regard to the various dissociation phenomena, we may now examine the process of carbonization and the decomposition of the hydrocarbons. Of the total heat generated, we have seen that the heat required for carbonization is very small. Now this heat has to do the following work: First, to raise the coal to such a temperature that the volatile constituents are driven off; secondly, to raise these to such a temperature that they interact one with another—dissociate or decompose. As regards raising the temperature of the coal through the various temperatures at which the volatile constituents are driven off, it is dependent on the specific heat of the coal partially carbonized or otherwise. But the heat required for the interaction and breaking-down of the volatile products depends upon other factors than specific heat—viz., the heat of formation of the primary compounds (the volatile matters at the instant they are evolved from the coal mass), and the heats of the formation of the products of their decomposition. It is obvious that the less of the primary products there are broken-down, the less heat is required. At the present so-called heat of carbonization, many of the primary products are degraded and interact one with another. Taking now only the hydrocarbons when discussing partial pressure, I pointed out that, by mixing two gases together at constant pressure the partial pressure of each constituent was lowered. So that considering each gas separately, we may suppose it as existing alone and under reduced pressure, combining this with the dissociation of a compound. The amount of dissociation depends upon the temperature T and pressure P. The dissociation being an inverse proportion to P—*i.e.*, by lessening the pressure, you increase dissociation with T constant.

You are aware that when dealing with reversible reactions $CO_2 + C \rightleftharpoons 2CO$ that for given T and P, there is a certain equilibrium. To what conclusion do these statements lead us? In the first place, they only seem to complicate matters very much. But, in reality, they simplify, for this reason: We are dealing only with hydrocarbons. Let us take, for example, the hydrocarbon of $C_n\,H_m + 2$ series, and the hydrocarbon when "n − 16" is $C_{16}\,H_{34}$, and suppose this to be present in the coal mass. On heating, as is the case with all paraffins, it is cracked to simpler molecules below its boiling-point; and these form a vapour phase, not necessarily of one type, but of several types. These would come into space above the coal mass. Some would come into contact with the hot crown, and be further degraded; and a relatively large volume of $H_2$ would be formed—this increasing the volume of gas, and thus lowering the partial pressure of the other compounds. And as it is to all intents and purposes a dilutent at constant pressure, this lowering of partial pressure will cause an increase of dissociation at the existing temperature. Of course, there will be a point at which some of the hydrocarbons would, by virtue of their unsaturated nature, polymerize or associate with other hydrocarbons of a similar type; but even for these there would, for various temperatures and pressures, exist equilibria—*e.g.*,

$$3\,C_2H_2 = C_6H_6$$
$$3\,CH \;\; C - CH_3 = C_6H_3(CH_3)_3$$

Considering the other gases formed by the action of heat upon the oxygenated bodies, there will exist the oft-recurring equilibria—

$$CO_2 + H_2 \rightleftharpoons CO + H_2O$$

$$C + H_2O \rightleftharpoons CO + H_2$$

This is in a measure due to the dilutions and consequent lowering of partial pressures causing a splitting-up of some of the heavier hydrocarbons, which under present circumstances go into the tar-well, instead of into the gas. It would appear probable, from a study of the above, and a knowledge of the predominant series at certain temperature and pressure, that were it required gas approximating to prearranged composition could be got.

We will now consider condensation. The physical and chemical laws affecting the process of condensation are to some extent similar to those instanced when considering carbonization, because, while in the latter we dealt with gases at high temperatures and with equilibria existing between them, in the former case—that is, in condensation—the equilibria is between liquids and their vapours and other gases. Condensation is the process whereby we remove undesirable liquids and solids from the gas by cooling. A common phenomenon is the spontaneous evaporation of water if left in an open vessel; while spirits often evaporate from a tightly corked bottle. What is the reason of this? I have mentioned that all gases tend to occupy infinite volume. Water vapour, being a gas, also has this property. Therefore, when water is placed in contact with an exhausted space, it gives off vapour and creates a pressure which is dependent on the temperature. Other liquids, and many solids, have this property. The pressure created is termed V.P. or V.T. Now, at each temperature there is a corresponding definite pressure; and this pressure increases with temperature T.

Under present methods, the sudden primary condensation of the crude gases causes the formation of tar fog—*i.e.*, tar is condensed in minute globules which have an enormous surface in contact with the gas. Now the V.T. of these heavy tars first formed is very low; and seeing that they are in the presence of vapours of the light oil, some are absorbed. This absorbtion will go on until the partial pressure of the light oils on the tar is equal to their partial pressure in the gas. If we allow this system—*i.e.*, the tar-fog together with the gas—to cool to a comparatively low temperature, the partial pressure of the light oils decreases, and more light oils must be taken from the gas to again give an equilibrium between the liquid and gaseous phases. So that the greater the cooling in presence of tar-fog, the less light oil vapour will remain in the gas. The effect on the naphthalene will follow along similar lines; so that the greater the cooling range in presence of this fog, the less the quantity of naphthalene in the gas. It is essential, however, that the maximum amount of light oils shall remain in the gas to afford the necessary illuminating power, so that the above process is faulty. Does there exist any other condition favourable to the absorption of naphthalene, and leaving the maximum amount of light oils in the gas?

We know that in the tar product of coal gas there are fractions of high vapour-tension—that is, for relatively low temperatures, the quantities remaining in the gas are large. Now, if we use these, the process of extraction becomes easier. I explained the formation and properties of tar-fog. If before this tar-fog has reached a temperature at which large quantities of light oil are extracted, it is removed either by the centrifugal machine introduced by Dr. Colman or some other suitable form of extractor, on further condensing we shall create a fog of the lighter constituents—the light oils. These, as they condense, will contain but small quantities of naphthalene, and the naphthalene in the solvent with have a low tension; and since this low tension cannot exist if we have an appreciable quantity of naphthalene in the gas, it must go into solution in the light oils, and be removed to the tar-wells. The effect of these light hydrocarbons condensing will not have the degrading influence on the vaporous illuminants that the heavy tar had, because the tension of these will not be much greater than that of the light tar formed. If we consider a mixture such as tar placed in a vessel, we have seen that a portion of the liquid will be vaporized; and if we now suddenly reduce the gas space above the liquid, more of the volatile components must evaporate to fill the additional space. The readiness with which this space will be reoccupied will, of course, increase with the temperature. Now, if, on the other hand, we suddenly compress the gas space above the liquid mixture, in order to restore equilibrium between the liquid and the gas for the particular temperature, some of the vapour must condense and enter the liquid mixture.

The cases just stated are parallel cases with vacuum and pressure condensations. From the above examples, it will be seen that the vacuum process tends to reduce, as the temperature falls, the solvent effect of the tars upon the lighter constituents of the gas, by reducing the tension of the vapours in the gas, and bringing the relative pressures of vapours in tar and gas close together. The effect of this reduced pressure on the naphthalene is not great, seeing that its vapour tension is so low, being at 15° C = 2 mm. of mercury, at 78° C = 9 mm., and at 100° C = 20·5. Pressure condensation has quite the opposite effect, in that it encourages the condensation of the lighter constituents which we know as illuminants. One point which should not be overlooked is the increased tendency of aqueous vapours to condense under pressure, and by their presence absorb greater quantities of $NH_3$, $H_2S$, and $CO_2$, and so relieve the washing and scrubbing plant.

Under the heading of solution of gases in liquids, we must first notice the law of Henry, verified by Bunsen, which states that the quantity of a gas dissolved by a specified quantity of a liquid is proportional to the pressure of the gas. That is, if we have a soluble gas in contact with water, a portion of this gas will be absorbed until an equilibrium is established between gas phase and liquid phase. If the pressure of the gas is increased either by restricting the gas space above the liquid, or by injecting more gas into the space, absorption will again take place, until equilibrium is restored between the two phases. Now the actual mechanism of the process is as follows: As soon as the gas and liquid come into contact, the surface layer of liquid absorbs gas until equilibrium is established by diffusion. The next layer then absorbs gas, until there is an equilibrium between gas and liquid. This goes on from layer to layer through the liquid, and continues until the partial pressure of the gas in the liquid is equal to that of its vapour. For a mixture of gases this law holds good; and each gas will be absorbed in quantities proportionate to its pressure in the gas mixture.

For purposes of calculation, the following formula is applicable: For unit volume of liquid and unit volume of mixture, let $q_1$, $q_2$, $q_3 - q_2$ = volumes of gas in unit volume of a mixture. Then the partial pressure of each gas is $q_1 p$, $q_2 p$, $q_3 p$, where $p$ is the total pressure of the mixture. Then, if $B_1$, $B_2$, $B_3$ = (Bunsen's) absorption co-efficient,

B = volume of gas reduced to 760° mm. absorbed by unit volume of liquid at 15° C.

∴ B = volume of gas absorbed at pressure per volume of liquid $(1 + 0{\cdot}00367t)$.

The quantities $g_1$, $g_2$, $g_3$, &c., are for unit volume of gases absorbed—

$$g_1 = B_1\, q_1 \frac{P_1}{760}$$

$$g_2 = B_2\, q_2 \frac{P_2}{760}$$

$$g_3 = B_3\, q_3\, \frac{P_3}{760}$$

The effect of temperature on the solutions of gases in liquids is to increase the pressure of these in the liquid; and consequently the absorbing power of liquids for gases at increased temperature decreases. If the gases react chemically, then they do not obey the laws of Henry. From the above facts, it is clear that, in the washing of crude coal gas, we must work at as low a temperature as is possible, having regard to the stability of the illuminating vapours. In order that equilibrium between gas and water may be quickly established, the surface layers should be constantly changed. The necessity for the division of the strong liquor from the weak is apparent from the appended figures. At normal temperature, 14 oz. liquor exerts a tension equivalent to 54 grains of ammonia per 100 cubic feet; and if this liquor is placed in contact with gas containing less than this quantity before equilibrium is established, ammonia will pass from the liquor into the gas. A liquor of 1 oz. strength is equivalent in tension to a gas containing 3 grammes per 100 cubic feet; so unless these liquors run in a reverse direction to the gas flow, it is impossible to completely scrub from ammonia. The quantities of $H_2S$ and $CO_2$ absorbed depend on the amount of $NH_3$ in the solution with which they form definite compounds; so that the $NH_3$ content of the liquor determines to a large extent the quantity of these impurities passing to the purifiers. Being soluble gases, both $CO_2$ and $H_2S$ are taken up, in accordance with the gas laws, by solution in water. There is at definite temperature a definite value for the equilibrium between $(NH_4)HS$ and $(NH_4)_2CO_3$; the $NH_4)_2CO_3$ being the most stable.

The physical laws governing the enrichment are similar to those governing condensation. The quantities of the various vapours retained in the gas depend upon the vapour tensions of the light oil vapours—the greater the tension, the greater the quantity retained. The effect of pressure on this system has been shown. As to the quantity of a hydrocarbon retained in a gas at any temperature, the following will serve to determine this quantity—

Let T = temperature of the gas.
V = volume of the gas.
$d$ = weight of 1 cubic foot of benzol vapour at T°.
$t$ = vapour tension of benzol at T°.

$$Q = \frac{V \times d \times t \times 100}{760} = \text{grains.}$$

$$\frac{\text{grains}}{7000} = \text{lbs. per gallon of benzol.}$$

Vapour tensions of benzol—

At 14° Fahr. = 14·97 mm. mercury.
" 32° " = 26·54 " "
" 50° " = 45·19 " "
" 68° " = 74·15 " "

$d$ at 50° Fahr. = 1576 grains.
60° " = 1547 "
68° " = 1524 "

With regard to stratification of gas in holders, were the mass a true gas, there would be no tendency towards stratification; but, as we have seen, the gas is simply composed of true gases—*e.g.*, H, N, $CH_4$—and vapours of hydrocarbons which as we know can exist as minute globules suspended in the gas at temperatures much below their point of liquifaction. So long as the gas is kept in motion and not subjected to excessive friction, the tendency of this "fog" to deposit is not great; and it will be carried considerable distances. If, however, this gas is allowed to stand for any appreciable time, and without elevation of temperature, which would disperse the "fog" by vaporizing it, then, by virtue of its specific gravity, it will gradually settle, and in doing so denude the upper stratum of a portion of its illuminants. We know from experience that carburetted water gas carries a considerable quantity of these lighter hydrocarbons in suspension; and when this gas is mixed with a coal gas poor in these light vapours, then a portion of this fog will disperse by vaporization, and not by mere settlement. If, however, this gas is mixed with a coal gas already saturated with light oil vapours, and then passed into a holder and allowed to stand even for a few hours, stratification will take place. Of course, a gas quite free from these suspended particles of liquid hydrocarbons will, on sudden cooling, tend to deposit by virtue of the V T of the liquids being reduced. In all cases, it is beneficial to distribute as soon as possible if illuminating power restrictions are placed upon the supply.

[In the paper, Mr. Tatam gave a brief description of the Lewes process for introducing hot water gas into coal-gas retorts.]

*Discussion.*

Dr. H. G. Colman congratulated Mr. Tatam on his paper, and the wealth of important matter contained in it. The author had rightly devoted considerable attention to what was generally known as the "water-gas reaction," for there was perhaps no reaction having such a widespread influence in all processes of gas manufacture. It occurred, of course, in the production of water gas itself, but also in the generators of the retort-settings, as well as in all the various forms of plant for the production of producer gas, and even in the gas-retorts themselves. Mr. Tatam had already given them the two equations, showing the manner in which steam acted on carbon at high and low temperatures, yielding hydrogen and carbonic oxide in the first instance, and hydrogen and carbonic acid in the second. There was, in addition, a third reaction of considerable importance—namely, that taking place between steam and carbonic oxide. When these gases were cooled together from a high temperature, the reaction $CO + H_2O = CO_2 + H_2$ took place to some extent. The amount of change increased as the temperature was lowered, and also with increase in the amount of steam present; while, on the other hand, if a mixture of carbonic acid and hydrogen was strongly heated, the reverse reaction took place, and partial reconversion into steam and carbonic oxide occurred. This was usually expressed by saying that the reaction was reversible; the equation being written $CO + H_2O \rightleftharpoons CO_2 + H_2$, thus indicating that the reaction could proceed in either direction according to the conditions of temperature. At about 500° C., only hydrogen and carbonic acid were present; but as the temperature rose their conversion into carbonic oxide and steam became more and more complete. All who had had experience with carburetted water-gas plants knew that when much steam was passing the generator undecomposed the percentage of carbonic acid rose very rapidly; and this was largely due to the action of the excess of steam on the carbonic oxide present as the mixture cooled. Again, just the same thing took place when wet coal was used in the retorts, partly because the evaporation of the water absorbed heat and lowered the temperature, and partly by the action of the excessive quantity of steam on the carbonic oxide. When, as in these cases, the illuminating power was of importance, this excessive formation of carbonic acid was most objectionable, as it involved increased cost, either for removal of the impurity or for enrichment to compensate for its depreciating effect on the illuminating power. If, however, the gas was only required for heating or power purposes, it was not of so much importance. A glance at the above equation would show that the effect of the change was to substitute carbonic oxide for an equal volume of hydrogen, or *vice versâ;* and as the calorific power of equal volumes of these gases was approximately equal, the resulting calorific power of the gas was but little affected. Hence in the Mond gas process a large excess of steam was deliberately used in the generators, as the slight disadvantage in the heating power of the resulting gas was more than counterbalanced by the ease of working the clinker in the generators, and especially in the prevention of the decomposition of the ammonia thereby brought about. The substitution of hydrogen for carbonic oxide in the gas had, however, one disadvantage when the gas was used in engines—namely, that with the increased percentage of hydrogen there was a greater tendency to pre-ignition of the explosive mixture in the cylinder. Again, in the bunsen flame, the water-gas reaction played a very large part. In the inner cone of the bunsen flame, the action of the primary air mixed with the gas was to effect a partial combustion, and to bring about the formation of hydrogen, steam, carbonic oxide, and carbonic acid—*i.e.*, the four gases concerned in the above reaction; and the relative proportion of these depended upon the temperature they were raised to in the inner cone, as had been shown by Smithells, Haber, and others. The carbonic oxide and hydrogen were finally burned to steam and carbonic acid in the outer cone, by combination with the oxygen of the external atmosphere. Mr. Tatam further referred to a former paper of the speaker's, on the separation of tar-fog from the crude gas while it was still hot, and the effect of this on the naphthalene and light oils left in the purified gas. Experimental work carried out since the paper was read had shown that the result of such removal of the hot-tar fog was, as anticipated, that the quantity of naphthalene left in the gas after condensation was decreased, and that of the light oil vapours increased. But it had also been found that in the case of the gas yielded by certain coals, particularly those from the Newcastle and Durham district, when carbonized at high temperature, the amount of naphthalene left in the gas after the removal of the hot-tar fog was so high, and that of the light oils separating out with it subsequently in the condensers so small, that the latter were present in insufficient quantity to dissolve the naphthalene simultaneously condensing, with the result that solid naphthalene was deposited in the condensers, causing stoppages. Thus, while with the coals used in the Midlands, if the temperature of carbonization was not exceptionally high, the plan would give satisfactory results, there was still some difficulty left to overcome with Newcastle coals, and probably in most cases where very high heats were employed. After the above-mentioned paper had been read, Mr. William Young, of Peebles—whose writings always deserved most careful consideration—published a paper, in which he forecast some such result in the case of Newcastle coals; and events had confirmed his (Mr. Young's) conclusions in this respect.

Mr. W. Chaney (Nechells) remarked that Mr. Tatam had referred to what he thought was a very neglected side of gas manufacture—the physical side. The paper was rather difficult to discuss at a moment's notice; but there was one little matter to which he should like to call attention—the dissociation of the hydrocarbons at various temperatures. This was a question of extreme interest, and one which he was afraid had also been neglected. With regard to the manufacture of water gas, there was a great deal of discussion as to the necessary heat; and looking at the question from a commercial standpoint, it was most requisite to know which hydrocarbons and which temperatures should be worked to, in order that success might be attained. In the dissociation of the hydrocarbons in water-gas manufacture, he presumed, there was a certain amount of light and heavy oils formed; and it had never been definitely settled which of these oils it should be the aim to dissociate. As regarded the stratification of gas, he knew that it did occur, though he did not think to the extent Mr. Tatam would have them believe.

Mr. H. E. Copp (West Bromwich) said that a few years ago he had occasion to do some coal-testing in iron retorts; and then, owing to a mistake, they found they got some rather extraordinary results, which they could not account for, as regarded the analysis of the gas produced. They came to the conclusion, however, that they were due to the fact that they were carbonizing at a vacuum. This, of course, was not possible with their present methods; but it was worth considering. There was no doubt that the composition of the gas was altogether different when produced under a slight vacuum. As to the Lewes process, he did not quite understand Mr. Tatam's remarks with regard to the breaking-down of the hydrocarbons, due to the introduction of another gas during carbonization. He understood him to say that the presence of blue water gas encouraged the dissociation of some of the higher unsaturated hydrocarbons. He (Mr. Copp) had always understood that the very object of introducing blue water gas was to prevent this, though it was questionable how far it succeeded. Mr. Tatam said the illuminating power was increased; but his own opinion at present was that this was doubtful. Then as to condensation, the question as to whether they should condense under vacuum or pressure was certainly a very interesting one.

Mr. L. Wilson (Stafford) said he should like to add his thanks to those of the previous speakers. The paper which Mr. Tatam had read to them was a highly interesting one.

Mr. J. H. Darrah (Nechells) remarked that he had been struck by the fact that the supporters of the anti-dip method of working the hydraulic main maintained that a higher illuminating power was obtained in that way. Yet he himself had noticed that, on increasing the seal, the illuminating power was raised, whereas by their argument it would be decreased.

Mr. S. T. Smith (Walsall), referring to the subject of condensation, said Mr. Tatam wanted to take the thick tar out straight away. There had, however, been certain theories brought forward that the longer the tar remained with the gas the more was the illuminating power raised. According to Mr. Tatam, if he understood him correctly, this would tend, instead of raising the illuminating power of the gas, to reduce it.

Mr. A. O. Jones (West Bromwich) thought that it would be an advantage if the members had an opportunity of reading a paper like Mr. Tatam's before it was discussed. He suggested that the papers should be printed before they were read. With reference to steam in the generator, he had always understood that a certain amount was a very good thing, to keep the generator cool. With regard to anti-dips, he did not think it was claimed that their use resulted in any large gain of illuminating power.

Mr. T. R. Murray (Saltley) said there was one point on which he should like to hear Mr. Tatam make some remarks, and that was the formation of carbon on inclined retorts as compared with

horizontals. This was a problem they had had to contend with to a very large extent. The rate at which the inclineds scurfed-up was roughly twice as fast as with horizontals. This was interesting, and seemed to be intimately related to some of the phenomena Mr. Tatam had described. He knew of one works where they had the exhauster interposed between the condenser and the retorts. At the Bankside station of the South Metropolitan Gas Company it had been tried, and he believed with success; but he did not know that it was done with a view to experimenting on the phenomena of condensation. It was, however, found that the exhausters ran much more easily, because the tar was not taken from the gas beforehand, and it acted as a natural lubricant.

The PRESIDENT proposed a very hearty vote of thanks to Mr. Tatam for his contribution, which, he said, emphasized the need for having the papers printed. He agreed that they should give more attention to the theoretical side of gas manufacture. No doubt in the future it would be a highly technical process; and the more technical it was, the more economical he thought it would be. The paper led them in the direction of recognizing all the phenomena which went on during the carbonization and gasification of coal. He should like to express the pleasure of the Association at seeing Dr. Colman with them that day.

Mr. SMITH seconded the proposition; and it was cordially agreed to.

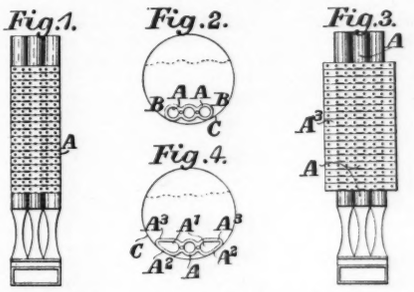
Mr. TATAM, after acknowledging the vote of thanks, proceeded to reply to the discussion. He said he was sure that the study on more scientific lines than was formerly done of the difficulties connected with gas manufacture would be of great benefit to the industry. Dr. Colman had shown them that under the Mond system a gas had been secured of more even calorific power at a low temperature than would have been obtained working at a high temperature. That was, the Mond people, by working at a low temperature, were able to keep their ammonia to a great extent undecomposed; and at the same time, although the proportion of carbonic acid in the gas was high, Dr. Colman had pointed out that after all, with this excessive quantity of carbonic acid, the calorific power was not reduced by such a very large amount. Mr. Chaney had remarked that stratification did not go on quite so much as he (the speaker) had imagined. His own observation, however, convinced him that stratification—especially where water gas was used—was a thing that would have to be carefully watched. Of course, it could be got over by arranging that the water gas should not contain an abnormal amount of the lighter hydrocarbons. As to Mr. Copp's remarks regarding condensation, Mr. Murray had kindly given some experience with which he was connected, seeing that it was at one of the London Company's stations of which he was an officer. He (Mr. Tatam) was speaking not long ago to a Works Superintendent at the Old Kent Road, and he asked him about condensation under pressure. He found that the Bankside station was really the only works where condensation under pressure was carried on; and Mr. Murray had told them that it was done there practically for the convenience of the exhauster, which ran more smoothly. He thought the fact that the pressure tended to drive the light oils out of the gas and into the tar, put pressure condensation almost out of the question. Mr. Copp had asked another question about the dissociation phenomena. In the Lewes process the hot water gas was put through the retorts; and the dissociation depended a great deal upon the pressure and the temperature. Taking a constant temperature, it simply meant that they were splitting up molecules. It only stood to reason that, if they decreased the pressure—that was, if they decreased the forces that tended to keep the molecules together—they must necessarily increase their tendency to decompose. Reducing the partial pressure by means of the hot water gas was equivalent to reducing the pressure of the hydrocarbons, and inducing them to dissociate. The relatively large quantity of water gas tended also to hurry the hydrocarbons out of the retort; so that while in one respect it aided dissociation, in another way it to an extent prevented it. He knew that there was a great diversity of opinion regarding the Lewes process, so he expected that, like many operations, it was purely a case of hitting upon the right conditions for the most economical and best working. Mr. Darrah asked a question about anti-dips. He (Mr. Tatam) had had some little experience with anti-dips; and he found that the anti-dip kept the production more steady and gave a more constant illuminating power altogether. As to tar condensation, Mr. Smith must have misunderstood him. He advocated taking the tar away from the spot where it had a tendency to take up the light oils at a too rapid rate. He recommended removing the tar while it was still hot, but not too near the condensing apparatus, because the heavy tar had a beneficial effect on extracting the naphthalene. As to Mr. Jones's remarks, the reason that steam was not beneficial to the generator was because it would absorb heat. The temperature of the generator was pulled down, and so the proportion of carbonic acid was increased. Consequently, when the gas went into the combustion chamber, instead of having the maximum of carbonic oxide, it would have a large proportion of carbonic acid, which would render it less effective for heating. With regard to the formation of carbon on inclined retorts, mentioned by Mr. Murray, this was in all probability due to the gases getting a travel against the crown of the retort, seeing that they would necessarily rush to the highest point.

# REGISTER OF PATENTS.

**Furnaces.**—Wilton, G., of Mark Lane, E.C., and Wilton, T., of Beckton. No. 24,785; Nov. 15, 1904.

This invention relates to furnaces of the type described in patent No. 9309 of 1895, wherein the fuel is disposed about or over blast-chambers or tubes lying along the base of the flue. In such furnaces, the blast-pipes are built up of sections bolted together; and in the preferred form usually employed each section consists of two or more circular portions cast in one, so as to form when assembled the required group of circular blast-pipes having perforations in their upper surface. When blast-pipes so made were laid in a circular flue, a gap occurred between the circular wall of the outside pipes and the wall of the circular flue, and which gap was naturally below the upper surface of the blast-pipes. The body of the fuel contained in the space is found in practice to cause burning away of the side of the blast-pipe; and further, there was a considerable gap between the outside row of perforations in the blast-pipes and the adjoining face of the flue.

According to this invention, the outside blast-pipe, or the sections which form it, are extended laterally, so as to more or less follow the



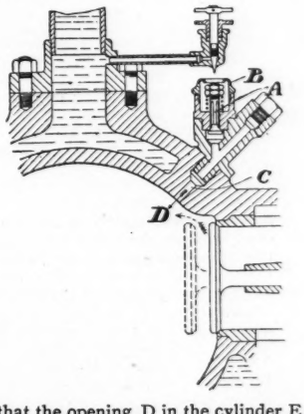

contour of the flue and so extend the blast area right up to the face of the flue, and at the same time provide such a support for the fuel that it does not rest in any deep cavities below the normal level of the upper surface of the blast-pipe.

Fig. 1 is a plan of the old form of circular blast-pipes built up of sections, and fig. 2 is a sectional elevation fitted to a circular boiler-flue. Figs. 3 and 4 are similar views showing the improved construction.

The old form of blast-pipes, of circular section, will be seen at *a* in fig. 2, as will also be the gap or recess *b*, in which the fuel enclosed on one side by the wall *c* of the flue and on the other by the sides of the circular sections caused the latter to become burnt through in a comparatively short time. In fig. 4, $a^1$ indicates the improved construction of the side sections, wherein the lower walls $a^2$ conform to the curve of the circular flue *c* and leave no gap or recess in which fuel can be enclosed.

**Internal-Combustion Engines.**—Crossley, W. J., of Manchester, and Atkinson, J., of Marple. No. 26,503; Dec. 6, 1904.

This invention is for a special method of introducing a little water into the cylinders of internal-combustion engines, with the object of (1), preventing pre-ignition of the charge; (2), the reduction of the sharpness of the initial ignition, so as to reduce the severity of the otherwise high pressure and strains consequent on the employment of large cylinders and high compressions; (3), the general reduction of temperatures in the cylinder throughout the whole cycle of operations; and (4), the reduction of temperature of the metal of the cylinder end and passages—"thus to some extent removing the strains caused by high temperature, and making it possible to use in a gas-engine cylinder very readily ignitable gases which under ordinary conditions would be very difficult to work with."




It will be seen that the opening D in the cylinder E of the engine is placed in such a position that the charge entering by the admission valve F (which is shown in full lines in its closed position and in dotted lines in its open position) is below it, and the sprayed water, together with the air entering with it, is delivered on to the top of the entering charge during the whole of the suction stroke. In a suitable position on the cylinder is fixed a small inward-opening self-acting valve A, having a cup-shaped receptacle B above it for the water, and a passage C below the valve into the cylinder. This passage terminates in the cylinder in such a position that the entering charge of gas and air during

the suction stroke sweeps past its opening D, so as to thoroughly and uniformly mix the water with the charge, and, as far as possible, prevent any of the water coming into contact with the walls of the cylinder or the end of the piston. The water is drawn into the cylinder by the suction, which also draws in the charge; and a little air is drawn in with the water so as to break it up into spray. The valve A opens with the suction to admit the water, but closes as soon as compression commences, and remains closed during the working stroke, so that nothing can escape outwards from the cylinder.

In some instances a small stream of water may be allowed to run continuously into the cup (as shown); but the patentees prefer to pump it into the cup, or directly into the cylinder, by a small pump worked by the gear which operates the gas-valve. So that when "hit and miss" governing is used, similar "hit and miss" delivery of water takes place, and water is only admitted when gas is admitted.

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**Sulphate Saturators of the "Self-Discharging" Type.**—Pettigrew, G., of Middlesbrough. No. 2840; Feb. 11, 1905.

The patentee claims as his invention: "Making a recess or hollow belt in the hopper of self-discharging saturators (substantially as shown) to enable the sulphate or other salt to pass to the outlet without obstruction." The illustration shows three vertical sections of the still, with the corresponding sectional plans. In the circular forms—figs. 1 and 2—there is a recess A, into which the circular part of the inlet-pipe I fits. The interior periphery, where the inlet-holes H are made, does not protect into the hopper beyond its

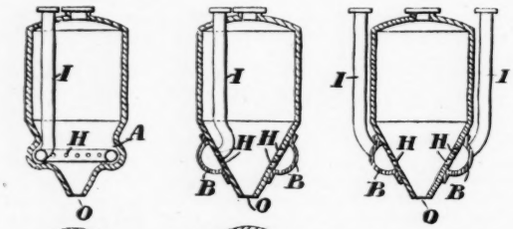


Fig. 1. Fig. 2. Fig. 3.

internal face—there being no obstruction to the passage of the sulphate to the outlet O, where a suitable discharge valve is fixed. In cases where it is desirable that the circular part of the inlet-pipe I should be fixed to the hopper, a hollow belt B is formed, and the inlet-holes H are made in the side of the hopper into the hollow belt. The ammonia then passes down the inlet-pipe I into the hollow belt B, and out through the holes H in the side of the hopper into the saturator.

In the rectangular type of saturator, with rectangular hopper, the hollow belt may be fixed as shown in fig. 2, or it may only be fixed round the hopper as shown in fig. 3. The two sides of the hopper are perforated with holes into the hollow belt. The ammonia inlets may be made on one or more sides, on the inside as shown in fig. 2, or a recess may be made in the hopper, on one or more sides of the hopper, and the inlet-pipe fitted into it as fig. 1.

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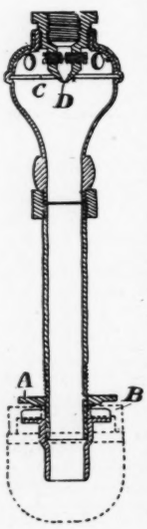
**Inverted Incandescent Gas-Burners.**—Allman, W., of Birmingham. No. 5901; March 21, 1905.

This invention has for its object to secure a more rigid attachment of the mantles and their supports to inverted incandescent gas-burners; also to provide a supply-controlling device in the gas-nozzle which enters the bunsen part of the burner. Hitherto it is found, says the patentee, that, should the burner be placed out of the vertical position, the mantles, and the supporting ring to which they are secured, are apt to fall out of line.




The patentee provides a screw-thread upon the burner-pipe; and upon this screw-thread is carried a screw collar A, which can be raised sufficiently out of the way for the proper placing in position of the mantle-ring and its projections, when the collar may then be screwed down on to the projections B, so as to firmly bind the mantle to the fitting, and the burner fitting or pipe may then be safely carried at any angular position without fear of the mantle falling out of its proper place.

The gas is made to enter the bunsen air-chamber C by means of a nozzle-fitting, whose inner end is furnished with a small central outlet D, and just above the outlet is a passage adjustable by means of two oppositely placed screws, whose inner ends are made flat-wise. Thus the space between the ends of the screws may be increased or decreased at will, and so form a cross slit-like passage for the gas to pass through ere it emerges from the nozzle into the bunsen air-chamber. By this device the flow of gas may be regulated in order to suit the requirement of the burner according to the pressure in the main.

**Mantles for Incandescent Gas-Burners.**—Lake, W. E.; a communication from Gasglulicht Gesellschaft Hamburg, M.b.H., of Hamburg. No. 17,871; Sept. 4, 1905.

In accordance with this invention, the texture hitherto employed for mantles is replaced by a fabric consisting of longitudinal or warp threads stretched as much as possible, or running slightly zig-zag and connected by random weft threads. The arrangement was referred to in a recent issue of the "JOURNAL"—Oct. 31, p. 294.

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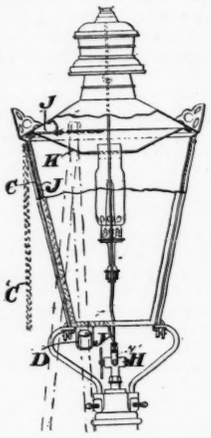
**Lanterns for Incandescent Gas-Lighting.**—Bray, J. W., of Leeds. No. 19,321; Sept. 25, 1905.

This invention has for its object the construction of a lantern provided with a flash-jet for igniting purposes, "in such a manner that the reflector is not blackened or otherwise affected by the action of the flash-jet flame, and the flash-jet flame is protected from draughts caused either by the action of the wind on the lantern or through the opening of the lantern door."




The lantern may be provided with a door C, or with a ball trap D, as described in patent No. 970 of 1882, arranged in such a manner that any ordinary torch may be used for igniting the gas. Between the burner and the gas supply-pipe is a three-way cock H, provided with one branch to which is connected a flash-jet tube J, conducted to above the reflector, which is provided with an aperture K in any suitable position. The flash-jet tube is brought adjacent to this aperture, and has mounted on it a burner so arranged as to throw a jet of flame across the top of the burner chimney or hole in the reflector, depending on the arrangement of the chimney.

The flash-jet is mounted above the reflector in such a manner that in burning it cannot blacken the reflecting surface of the reflector, and at the same time the flash-jet flame is thoroughly protected from draughts.

The aperture K is arranged in such a manner as to form a guide for the torch, and at the same time it tends to prevent the torch coming in contact with the glass chimney.

In operation, the three-way cock is turned into such a position that the gas to both the burner and flash-jet is turned on. The torch is then inserted either through the ball trap D or door C, and passed up through the aperture K. On the torch being withdrawn, the pilot-jet flashes over the chimney or aperture in the reflector and ignites the burner-flame. The pilot-jet flame is turned out by a further movement of the three-way cock.

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**Propeller Apparatus for Charging Gas-Retorts.**—Eitle, C., of Stuttgart, Germany. No. 10,065; May 13, 1905.

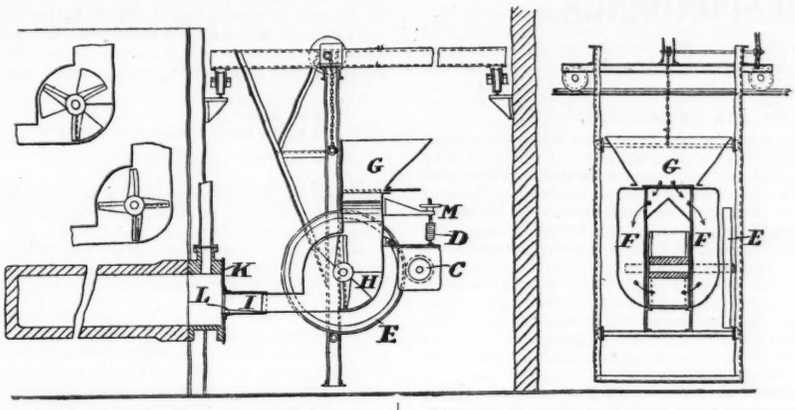
This invention relates to the charging of horizontal retorts, of any usual length and cross section, by means of a revolving propeller the axis of which is horizontally arranged.

The illustration (p. 689) shows a longitudinal and cross section of the apparatus with a two-wing propeller; also cross sections through the propeller casing showing propellers provided with three and respectively with four wings or blades.

The propeller casing is fitted with a winged shaft rotating inside and driven by an electro-motor C, the casing of which is journalled on a pivot or trunnion. The shaft of the electro-motor is provided with a friction-pulley, which is pressed by a spring D against the periphery of the fly-wheel E mounted upon the propeller shaft and made heavy, so as to act as a storer of force. The propeller casing provided, as described in patents No. 23,008 of 1903 and No. 16,231 of 1904, with slantingly arranged channels or passages F, which, starting from the receptacle G, open at each side by means of a sector-shaped opening H into the lower part of the propeller casing. The direction of the passages changes several times as shown; the ejection nozzle or mouthpiece, the front part of which (I) is longitudinally displaceable and provided with a retort-lid K and a distributing saddle L. These parts (combined in a frame) are guided by rollers either in a suspended or an upright frame, secured to an overhead crab or a travelling carriage; and they are vertically displaceable to correspond with the positions of the retorts, as described in the earlier specifications.

The spring D (intended for the regulation of the pressure of the friction-pulley against the fly-wheel) is threaded at its free end and provided with a hand wheel M, and also with a graduated scale, by means of which the pressure of the friction-pulley against the fly-wheel can be exactly regulated.

The patentee remarks that the lengths of retorts at present in use vary between about 10 feet and 20 feet, and the shape and size of the cross sections of the retorts differ also; so that the quantities of coal to be charged in proportion to the unit of length also differ. The height or quantity of the material charged by this apparatus is determined by the pressure of the friction-pulley against the fly-wheel by the adjustable spring, and on the level of the ejection nozzle in relation to the retort. A greater charge requires greater pressure of the friction-pulley and a higher level of the ejection nozzle. The length of throw is dependent on the speed of the propeller wings or blades (a longer throw requiring a greater speed of the propeller), and also upon the selection of a corresponding number of wings or blades; the number of blades being reduced in the case of greater lengths of throw and greater speed. It has been found that for retorts of about 10 feet length four blades, for retorts of about 15 feet length three blades, and for retorts of about 20 feet length two blades, are most suitable.




The momentum imparted to the fly-wheel before the charging is begun is gradually consumed during the charging operation, which starts at the extreme end of the retort; "so that the speed of the propeller decreases proportionately as the charging of the retort proceeds towards the front end."

Besides the employment of propellers with four, three, or two blades for the different length retorts (the blades when less than four being provided with sector-shaped side walls), the essential features of this invention consist in the arrangement of a heavy fly-wheel on the propeller shaft, driven by a friction pulley rotated by an electric motor or its equivalent, and in means for regulating the pressure of the friction-pulley against the fly-wheel. By this means, the speed of the fly-wheel, and the momentum it acquires before the changing commences, can be varied, as the slip of the friction-pulley decreases with an increase of its pressure against the fly-wheel; while from the same cause the momentum of the fly-wheel decreases more rapidly with a light pressure. Thus, after the pressure has once been regulated according to the length of the retort and the number of blades, "the charging proceeds uniformly without any further attention of the operator being required."

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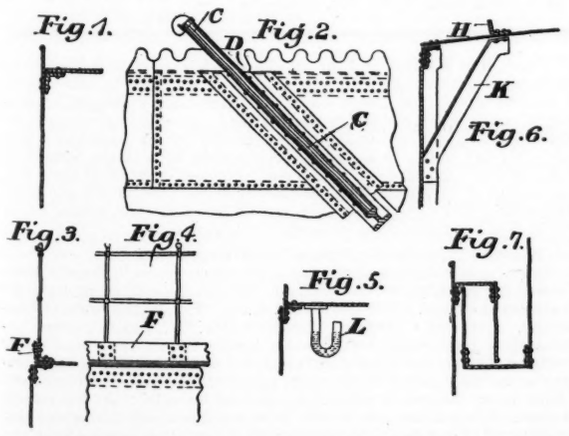
**Gasholders.**—Dempster, R., of Manchester. No. 20,903; Oct. 16, 1905.

These improvements relate more especially to spirally-guided gasholders, with the object of providing means whereby defacement or disfigurement of the sides may be obviated or greatly reduced.

With gasholders as at present for the most part in use, the patentee remarks, the sooty or other deposits collected upon the crown are washed down the sides by rain, and present disfiguring stains, marring the finish of the holder, particularly in cases where light paint has been employed. This is more especially so in holders with spirally mounted rails for guiding them in and out of the tank, "for, whereas the portions of the shell vertically beneath the oblique rails are protected, the remaining surface becomes dirty from the cause referred to, and a very unsightly effect results."

To obviate this, so far as the top portion of a holder is concerned, the patentee forms, at or near to the edge of the crown, a ridge or gutter for the collection of the water. This may be accomplished by extending the top row of side plates above the edge of the crown; by turning up the edges of the outer crown plates round the holder; by attaching to the crown or side plates a curb or ring of angled pieces; or otherwise by providing an upwardly projecting rim about the top of the holder, capable of collecting the water which drains from the dome.




Figs. 1 and 2 show a vertical section and an elevation of part of the top of a spirally-guided holder, provided with one form of these improvements. Figs. 3 and 4 are similar views showing a modification, and figs. 5, 6, and 7 are vertical sections disclosing further variations.

In figs. 1 and 2, the side plates are extended for a distance above the level of the edge of the crown, so as to arrest the water, as described. The top of the rim, in this instance, is scolloped, for ornamental purposes. A recess in the scolloped edge, at D, is formed of extra depth—that is, down to the level of the crown's edge, or thereabouts—to permit the collected water to run on to, and down, the upper surface of the rail C. In figs. 3 and 4, an external ring F, of angled plates, is formed at the extremity of the crown. This water collector has the additional advantage of further stiffening the curb; and, moreover, it provides a convenient means of attaching the hand railing. Fig. 5 shows a form of collector provided by turning up the edges of the crown plates at the curb. In this case, the rim is not shown provided with an outlet (though one may be employed if desired); but, in lieu, an inlet is formed in the crown of the holder, in connection with a seal-pipe L, by means of which water is conducted to the interior of the holder. Fig. 6 illustrates a mode of attaching a rim of angle-plates H, in conjunction with internal stays K.

Where the collecting rim is situated, for any reason, at some little distance from the edge of the crown, it may be preferable to provide channels to conduct the water to the sides of the holder; but, in most cases, the rim should be as near the edge of the crown as practicable.

In fig. 7, the invention is shown applied to the dip connection or joint between one lift of a holder and another. An extension of the side-plates is here illustrated, as in fig. 1; and, if desired, the water may be allowed to flow into the seal.

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## APPLICATIONS FOR LETTERS PATENT.

22,512A.—Newton, H., "Valves for use in gas-producers." Nov. 22.
22,512B.—Newton, H., "Scrubbers for use with gas-producers." Nov. 22.
23,851.—Cook, E. S., and Chipperfield, W. H., "Production of combustible gas." Nov. 20.
23,877.—Lockhart, J., "Mounting of mantles." Nov. 20.
23,883.—Potter, W. G., "Inverted burners." Nov. 20.
23,913.—Cobb, B. G. & W. F., "Gas turbine." Nov. 20.
23,966.—Walker, J. S., "Manufacture of air gas." Nov. 21.
24,000.—Stoneham, H. S., and Pearson, R., "Manufacture of cyanides and ammonia." Nov. 21.
24,022.—Fowler, S. J., "Stand-pipes and connections for gas-retorts." Nov. 21.
24,032.—Export-Gasglühlicht-Ges. m. b. H., "Forming and hardening incandescent gas-light bodies." Nov. 21.
24,128.—Heyden, W. van der, "Gas enrichment." Nov. 22.
24,136.—Export-Gasglühlicht Ges. m. b. H., "Making incandescent bodies for inverted gas-lights." Nov. 22.
24,137.—Dürr, F., "Indicating the quality of gas flowing from gas-generators." Nov. 22.
24,200.—Benard, P., "Lighting inverted burners." Nov. 23.
24,223.—Glas, E., Jun., "Igniting incandescent burners." Nov. 23.
24,243.—Auerbach, A., and Gleim, F., "Distant gas-lighter." Nov. 24.
24,274.—Herrmann, M., and Lorenz, L., "Incandescent burners." Nov. 24.
24,311.—Sugg, W. T., "Lamplighters' torches." Nov. 24.
24,340.—Harrison, C. W., and Noad, A. C., "Gas-burners." Nov. 24.
24,382.—Sutherland, A. G., "Prepayment meters." Nov. 25.
24,387.—Hall, J. A. F., and Stevens, L. C., "Incandescent burners." Nov. 25.
24,398.—Hills, H. G., "Enriching gas." Nov. 25.
24,410.—Francis, A. S., "Lamps for inverted burners." Nov. 25.
24,433.—Marconnet, G., "Gas-generators." Nov. 25.

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**Bursting of a Water-Main in Wandsworth.**—The bursting of a water-main running under High Street, Wandsworth, opposite the public baths, caused serious inconvenience last Thursday. Many houses were without water, which had to be fetched from neighbouring drinking-fountains. The most serious loss was caused to the laundries in the borough, where the lack of water prevented many women from working.

**Gas Supersedes Electricity at the Camborne Free Library.**—The lighting of the Camborne Free Library, which was some time ago changed from gas to electricity, is now once more to be carried out by means of the older illuminant. Tenders were invited; and the Electricity Company quoted £24 13s. 6d. (including rent of wires and meter), as against the Gas Company's £16. Before coming to a decision on the matter, the Committee asked the opinion of the Librarian; and he expressed himself as well satisfied with the incandescent gas lighting, which he thought was equal to electricity. The gas-fittings had been in position for about a week, for the purpose of testing the light. It is not surprising that with this testimony before them, and the great saving in cost, the Committee should have decided to accept the Gas Company's tender—the sum to include all renewals and a consumption of 80,000 cubic feet of gas per annum, anything above this quantity to be paid for at the rate of 4s. per 1000 cubic feet.

# CORRESPONDENCE.

*[We are not responsible for the opinions expressed by Correspondents.]*

## Leicester and Naphthalene.

SIR,—Judging from his communication in your last week's issue, Mr. Bell is evidently satisfied that, although Leicester continues free from naphthalene trouble, the gas being supplied contains a considerable quantity of naphthalene in excess of that stated in your issue of Oct. 4, 1904—viz., about 1 grain per 100 cubic feet, and, moreover, that this freedom from naphthalene is owing to the use of a solvent corresponding to that employed at Derby. He is entirely wrong.

During the twelve months ending Thursday last, Nov. 30, the gas at the offices in the centre of the town was tested daily for naphthalene. The highest test recorded was 1·72 grains per 100 cubic feet; the lowest, "a trace"—the average for the year being 0·96 grain per 100 cubic feet. Prior to the introduction of the solvent washing, the naphthalene in the gas at the Town Offices was anything from a little under a grain up to 8 or 10 grains per 100 cubic feet.

As I have previously stated, the remedy applied at Leicester is quite different from the Derby remedy; the respective solvents employed coming from entirely distinct series of tar distillates—the former being obtained from distillates most abounding in naphthalene. Analysis determines how distinct they are; and their commercial value further emphasizes the fact, as will be seen from the following table:—

*Analysis of Naphthalene Solvents.*

| Description of Solvent. | Sp. Gr. at 60° F. | First drop. | Percentage of Distillate at Various Temperatures. 160° | 160° to 170° | 170° to 180° | 180° to 185° | 185° to 190° | 190° to 194° | 194° to 196° | 196° to 198° | 198° to 200° | 200° to 205° | 205° to 215° | Residue. | Solid Matter at 40° F. | Naphthalene absorbed per 100 c.c. at 70° F. | Price per Gallon. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | P. C. | P. C. | P. C. | P. C. | P. C. | P. C. | P. C. | P. C. | P. C. | P. C. | P. C. | P. C. | P. C. | Grammes. | |
| LEICESTER.—Obtained from Tar Distillates where Naphthalene abounds. | 985 | 128° | 3 | 7 | 17 | 11 | 10 | 12 | 5 | 5 | 5 | 10 | 11 | 4 | 26* | 10 81 | 4d. |
| DERBY. — Obtained from Tar Distillates before Naphthalene is found. | 910 | 150° | 25 | 30 | 23½ | 7½ | 5 | 5 | | — | — | — | | 4 | 5 | 26·67 | 8d. |

* Probably, to a large extent, Indene ($C_9 H_8$).

Mr. Bell cannot appreciate that any substantial financial saving is to be effected by overcoming the naphthalene difficulty. In referring to the Leicester balance-sheet for the last half year, he remarks that the increased profits amounted to only £1500. Granted, but allow me to point out that the revenue for that period was reduced by:

| | |
|---|---|
| Less for gas | £1,625 |
| Less for coke | 7,506 |
| Less for tar and liquor | 1,577 |
| Total | £10,708 |

And that in spite of this reduction in income, the net profit was £1520 in excess of that for the corresponding half year, due very largely to the absence of naphthalene.

With a view of assisting him to realize the influence the presence of naphthalene has upon the working and financial results of a gas undertaking, permit me to present two Leicester pictures.

*The First Picture—*

Communications for ever in the Press complaining of bad gas.
Letters at times threatening dire consequences if &c., &c.
Frequently over a hundred men belonging to the Gas-Fitting Department scouring the town, clearing from naphthalene, and trying to keep consumers pacified.
In the Mains and Service Department, expenditure of £2000 for the year for taking up, and laying enlarged, mains and services that would never have been touched but for the scourge.
Hundreds of cases of stoppages reported, and attended to daily, to which might be added numbers of others where consumers suffered in silence.
As to the public lamps, well the less said about these the better.
At the works, the make of gas per ton being repeatedly reduced by lowering the temperature of the retorts in the hope of relief which never came therefrom.
More or less naphthalene throughout the plant and apparatus, with the inlets to the gasholders from time to time completely blocked.
Governors for ever sticking.
Indeed, life a misery to everyone, and loss occurring on every side.
An ever anxious, but most patient, Committee.

*The Second Picture—*

Not a trace of naphthalene found in any main, large or small.
Services, wherever examined, absolutely free.
Not a whisper of bad gas from anyone.
Not a lamp but is doing its full duty, and some even a little more.
At the works, the whole of the apparatus, from oil-washers onward, as free from naphthalene as when erected.
No anxiety as regards retorts being overheated; but an indifference to anything of the kind, and
A make per ton such as permits happy anticipations regarding working results, arising from a reduced coal bill and wages account.

"Life is now worth living," a member of my staff is very fond of urging; and, as stated by my Chairman, and shown, our savings are certainly substantial.

There is still a great deal to learn with regard to this subject; and I am inclined to think that our American kinsmen are going to assist us not a little.

ALFRED COLSON.

*Leicester, Dec. 2, 1905.*

## De Laval Turbines in Gas-Works.

SIR,—We have noted with interest the references to the use of De Laval turbines in gas-works in Mr. Herring's paper at the recent meeting of the Southern Association of Gas Engineers and Managers, and the subsequent discussion and correspondence. It occurs to us that a few further facts in this connection may be of some general interest.

We are in a position to speak with authority on this subject, as we hold the sole rights for the sale of the De Laval turbines for all purposes in connection with gas-works in the United Kingdom and the Colonies, and we have supplied all the machines hitherto installed. The use of this machine in gas-works was developed by us in our endeavour to find a means of direct driving the centrifugal blowers in connection with our carburetted water-gas plant, and thus avoid the necessity of belting.

The first turbines were supplied by us with our carburetted water-gas plant at Romford, and were described by Mr. Child in his paper read at the meeting of the Incorporated Gas Institute on June 11, 1902, and mentioned by him in the discussion upon Mr. Herring's paper already referred to. The first of these machines was put in operation in November, 1901.

Since then we have adapted the turbines to centrifugal "boosters" or pressure-raising fans; and we have supplied a number of these machines for this duty, as well as in connection with electric dynamos. The first pressure-raiser was that supplied by us to the Tottenham Gas Company, as mentioned by Mr. Broadberry in the discussion on Mr. Herring's paper. This machine was put in operation in November, 1902. The next turbine which we supplied for "boosting" purposes was in connection with the fan at the Dover Gas-Works, described by Mr. Herring. This was put into operation in November, 1904.

HUMPHREYS AND GLASGOW.

38, *Victoria Street, S.W., Dec. 4, 1905.*

**Leeds Gas Workers and the Six-Day Week.**—After fully discussing the present position of the dispute with their workmen on the subject of Sunday labour, the Leeds Gas Committee have appointed a Sub-Committee to go further into the matter. The Gas Committee are desirous of continuing Sunday labour, but giving the present workers only a six-day week—thus finding employment for a larger number of men; but this the men contend would increase, instead of diminish, the amount of Sunday labour, which they would like to see abolished altogether. The objection of the employees to let the matter go to arbitration was reported in last week's "JOURNAL."

**Pumping Plant for the Epsom Water-Works.**—An inquiry was held at Epsom last Wednesday into an application by the Urban District Council for power to borrow £5600 for the provision of pumping plant at the water-works. The Clerk (Mr. E. G. Wilson) said that in September, 1904, the Consulting Engineer (Mr. W. Vaux Graham) reported that there were difficulties in supplying the town with water owing to the enormous consumption in dry weather. It became necessary to use the whole of the pumping plant on one occasion for 19 hours. There was an abundant supply of water in the wells; but the growth of the town demanded that an addition should be made to the pumping machinery. The Council had considered the merits of steam-driven and electrically-driven centrifugal pumps, and had decided in favour of the former. Subsequently, however, they abandoned both of these proposals in favour of suction-gas plant, by means of which it was estimated that there would be an annual saving of £512 as compared with the steam plant. Mr. Vaux Graham's estimate amounted to £5600 for the suction-gas plant, as compared with £6500 for steam pumping. Some opposition was offered to the proposal; an opinion being expressed that the electric light plant should be utilized for the purpose. Dr. Beaumont, however, said the Council objected to this, on account of the expense.

# LEGAL INTELLIGENCE.

## SUPREME COURT OF JUDICATURE—COURT OF APPEAL.

**Monday, Nov. 27.**

(*Before the* MASTER OF THE ROLLS *and Lord Justice* MATHEW.)

### Metropolitan Water Board v. Westminster City Council.—The Cost of Reinstating Roads.

This was an appeal by the Metropolitan Water Board from the judgment of the Divisional Court on a special case stated by Mr. Bros, one of the Metropolitan Magistrates; and it raised the question whether or not the Westminster City Council were justified in charging 10 per cent. on the cost of doing certain work in making good the roads after they had been opened to repair the water-mains. The Divisional Court held that the Council were entitled to make the charge as an expense incurred by them under section 114 of the Metropolis Management Act.* By the terms of this section, the Council were entitled to get back from the Water Board the cost of repairing the road.

Mr. DANCKWERTS, K.C., who, with Mr. COURTHOPE MUNROE, appeared for the Water Board, said it was admitted that if the work was not done by the Council, but by the Water Board, they would not be entitled to make the charge; but it was said that as they chose to take upon themselves the duty of doing the work, they were entitled to make the extra charge on the actual cost by way of compensation for supervision, which charge it was said represented the general expense of the Council in keeping up a staff continuously. When the case came before the Court of Appeal, it was held that this charge could not be maintained; but a further point was then raised. It was said: "True, we cannot make the general charge, but we have incurred something in the shape of extra supervision;" and the Court ordered that this point should be ascertained as a fact before the appeal was disposed of. Accordingly, the case was sent back to Mr. Bros, who, after hearing evidence, found that no substantial extra expense had been incurred by the Council. Upon this finding, the Water Board asked for the appeal to be restored to the paper for argument.

Mr. M'CALL, K.C. (with him Mr. MORETON SMITH), for the Council, said he could not dispute that on this finding the appellants were entitled to succeed. To restore the case to the paper would be simply to incur unnecessary costs.

The MASTER OF THE ROLLS: Then that disposes of the appeal.

Mr. DANCKWERTS said no doubt that was so; but as this was in the nature of a test case, he should ask the Court to deliver judgment on the point for the guidance of the Board in the future.

THE MASTER OF THE ROLLS said the Court could not give judgment when it would be purely academic.

Mr. M'CALL said he did not admit any general proposition of any sort or kind, but merely, on the finding of fact by the Magistrate, that he could not further argue the appeal.

The appeal was accordingly allowed, with costs.

## HIGH COURT OF JUSTICE—CHANCERY DIVISION.

**Thursday, Nov. 30.**

(*Before Mr. Justice* BUCKLEY.)

### New Inverted Incandescent Gas-Lamp Company v. Cope and Timmins, Limited.

In this case, the plaintiffs, who are the proprietors of two patents (No. 5769 of 1900, granted to Josef Bernt and Emanuel Cervenka, and No. 265 of 1903, granted to Armand Farkas), sought to restrain the defendants from selling any incandescent burners made under these patents, or any burners only colorably differing therefrom. The defendants denied infringement, and alleged that the patents sued upon were invalid.

Mr. MOULTON, K.C., and Mr. J. W. GORDON (instructed by Messrs. Steadman, Van Praagh, and Gaylor) appeared for the plaintiffs. Mr. A. J. WALTER and Mr. J. H. GRAY (instructed by Messrs. Mackrell, Maton, Godlee, and Quincey) represented the defendants.

Mr. GORDON, in the absence of Mr. Moulton, opened the case. He said the action was brought in respect of two patents relating to inverted incandescent gas-burners of which it was admitted the plaintiffs were the registered owners. The upright incandescent gas-mantle had been known for some years. As, however, it had the disadvantage of casting a shadow, many attempts had been made to obviate this defect; and the whole merit of the plaintiffs' invention consisted in the fact that it practically solved this important problem. It was found that if the flame was a little too large or too small it did not properly fall into the mantle, with the result that incandescence was not obtained throughout; and it was therefore necessary to have a burner which was capable of being regulated so as to give the exact mixture of air and gas to produce incandescence. This quantity was well known for upright burners, but directly the burner was inverted the whole position was altered; and it was to overcome this difficulty that the design in question had been put on the market. The learned Counsel then proceeded to direct the attention of his Lordship to the two patents.

**Friday, Dec. 1.**

Mr. GORDON, in resuming his argument this morning, explained at some length the nature of the claim, which consisted in the combination of an isolator with a deflecting cone and bunsen burner. In all the 23 prior specifications which were put forward as anticipations, it had not occurred to anyone that it was necessary to get rid of the regenerative action; but this had been successfully accomplished by the plaintiffs by means of the isolator and deflector. He asked the Court to say that the patent was a valid one, and had not been anticipated. It was true the patent had already been the subject of litigation; but in the action against the Globe Light Company, Mr. Justice Joyce did not express any opinion as to validity, as the defendants succeeded on the point of non-infringement. It could not be said that there was no infringement in the present case, as the defendants' combination consisted of a bunsen burner, deflecting cone, and isolator—the same as that of the plaintiffs.

Professor *Vivian B. Lewes*, examined by Mr. GORDON, said he had made a special study of incandescent lighting, and had had considerable experience of burners for it. In the Bernt and Cervenka specification, the inventors described the phenomenon which occurred when an ordinary bunsen burner was inverted. The up-currents of heated air had a tendency to draw the flame upwards, and the flame lapped back to the side of the tube. This phenomenon was badly described by the inventor as "striking back." As soon as the tube became hot, it caused a current of air to suck the flame farther back, and run up the exterior of the burner. The inventor would have more clearly expressed what he meant if he had described the operation as "lapping back." The essential feature by which the inventor overcame the difficulty was to fit the bunsen burner with an isolator to take the flame further away from the burner, where the mixture of air and gas took place. When inverted, instead of the air-holes sucking in pure air to support combustion, they sucked in a certain portion of the products of combustion, which gave a flickering flame. To get over this difficulty, a deflector was put on, which caused the products of combustion to take a different path. A regenerative burner was one in which some or all of the heat of combustion was utilized to heat-up the gas or the air, or both, before they reached the point of combustion. Regenerative burners were well known at the date of the patent. The invention here did not consist of using a regenerative burner. The object was rather to avoid heating. If the tube of a bunsen burner, in which there was a mixture of air and gas, was heated, the ratio of air to gas was entirely upset. It was a distinct advantage to dispense with the principle of regenerative heating in burners of this class. Plaintiffs' invention was undoubtedly a useful one; and the utility of it was shown by its great commercial success. It was certainly new at the time it was brought out in 1901. He had examined the construction of the defendants' lamps, and found they contained a bunsen burner, a mantle suspended head downwards, an isolator which served the same purpose as that in the plaintiffs' lamp, and a deflecting cup which answered the same purpose as the plaintiffs' cone; so that, in fact, the differences in construction were immaterial. In his opinion, the defendants' burner clearly embodied many parts of the plaintiffs' invention. The Farkas patent was entirely novel at the time it came out, and had not been anticipated, except perhaps by the Bernt and Cervenka patent.

**Saturday, Dec. 2.**

This morning Professor *Lewes* was recalled and cross-examined. He assented to Mr. Walter's description of a bunsen burner, of which the Welsbach "C" burner was an example, adapted for use with a mantle, and said it would burn turned upside down. [A photograph of such a burner, with an ordinary mantle, burning upside down, was produced.] It was essential to successful incandescent lighting that the mantle should be bathed in the hottest portion of the flame. The mantle shown in Bernt and Cervenka's specification was an ordinary one with the end cut off. This shape had never been on the market in this country; but it had a certain amount of success in Germany. He did not agree that the only thing necessary to success with an inverted burner was to get the mantle to fit the flame. The first thing was to get the proper shaped flame; and this was the object of the patent. The isolator was designed to keep the nipple of the burner as far from the flame as possible, and so to keep the mixture of gas and air cool, The conical deflector was for the same purpose. In the Globe case. Mr. Justice Joyce held that these features were not present; but he (witness) did not agree with him. He did not know that the plate at the bottom of the "C" burner was called the "lighting-back" plate; but he should not be surprised if it were. One must prevent the products of combustion getting into the burner. Inverted bunsen burners were well known. An ordinary bunsen burner inverted would produce a good light if the mantle were properly adapted to it, and means taken to secure a steady flame by keeping the products of combustion away. This was what the Globe burner did. There was no provision in the Globe case to keep the burner cool, except the length of the tube. The plaintiffs' specification was based on the theory of keeping the tube cool, and their mechanism was designed with this object, among others. The article put on the market by the plaintiffs was not made as shown in the specification, but in accordance with the theory of the patent. The main portion of the burner was made of porcelain; but he did not know that a great deal of its merit was due to the material of which it was made. China had advantages as a burner material. He contended that the defendants' burner No. 2 contained both an isolator and a deflector, though it was a short burner. The isolator had very little effect. A drawing was shown to witness, and he said it would be within the plaintiffs' specification. On Mr. Walter remarking that this was the plaintiffs' article with everything taken off it which was claimed in the specification, witness said he did not quite agree with this. He was then cross-examined on the plaintiffs' specification, and agreed that one of the principal features in it was that the burner ought to be kept cool; it was not to be in any way a regenerative burner. The free passage of the air and gas, without any obstruction by wire gauze, was another important feature; that was a novelty in connection with incandescent gas lighting. The deflecting cone was another important feature of the invention. Turning to the alleged infringement No. 2, he did not think the burner was intended to be regenerative; but it was so in fact, as all such burners must be, unless special precautions were taken, which was not the case here.

* See "JOURNAL," Vol. LXXXIV., p. 360; Vol. LXXXVI., p. 453; and Vol. LXXXVIII., p. 854.

No. 1 was similar, with the exception that the bunsen tube, or "isolator," as he termed it, was covered with another tube, and there was a hood or bell surrounding both tubes. He should not think this made the burner more regenerative. He had not tried the experiment; and if Mr. Swinburne said he had tried it, and found it was hotter, he could not contradict it without repeating the experiment. Farkas used an air-jacket to assist in keeping the burner cool. If it had the opposite effect, it would be a point against his patent. If it was a regenerator, it could not be an insulator; but whether, if this fact were established, it would invalidate the patent, was a legal question which he would leave to Mr. Moulton. Witness was then taken through the alleged anticipations, beginning with Rawson's patent of 1886, the idea of which was regeneration. It was found to be impossible to make the burner, probably from difficulties with the mantle. It had a deflector which formed a shield, preventing the flame from entering the air-holes of the burner. The plaintiffs' patent did away with all the complications of Rawson's specification. He did not think the latter would work at all, even if used with a modern mantle. He believed that within three minutes the flame would become luminous, and blacken the mantle. He admitted that Bernt and Cervenka did not give any proportions, so as to secure the right mixture of gas and air, because they differed according to the quality of gas and other conditions.

The further hearing was adjourned till Thursday next.

## HIGH COURT OF JUSTICE—REFEREES COURT.

(*Before Mr.* MUIR MACKENZIE.)

### East Ham Corporation v. Ilford Gas Company—Assessment of Damages Caused by Floods.

This was an inquiry into the damages alleged to have been sustained by the plaintiffs in consequence of floods which took place in June, 1903, and which the Jury, at the trial of the action, found had been caused by the negligence of the defendant Company.* The verdict returned by the Jury, in answer to questions put to them by the Lord Chief Justice, was to the effect that the defendants had been guilty of want of reasonable care in reinstating the river bank, and in closing the bed and channel of the Aldersbrook, which flowed through the Ilford Gas-Works. The reinstating referred to was that done after passing two gas-mains through the river bank; and the closing or filling in of the Aldersbrook was done, as the defendants contended, in accordance with their statutory powers. They further said that the floods were attributable to unprecedented rains; but the Jury found that the flooding of the plaintiffs' land was not due directly to natural causes, but could have been prevented by foresight and reasonable care. This being the finding of the Jury, it was agreed that the question of damages should be submitted to the Official Referee. The proceedings before him were commenced on Monday, the 27th ult., and were unfinished yesterday.

Mr. MONTAGUE LUSH, K.C., and Mr. L. M. RICHARDS appeared for the plaintiffs; Mr. H. E. DUKE, K.C., and Mr. SYLVAIN MAYER represented the defendants.

Mr. LUSH, in opening the case, said the amount claimed was now £913, which was a smaller sum than that originally demanded; it having been impossible, in some cases, to give anything more than a mere estimate of the cost which would have to be incurred in repairing the damage caused. Some of the work was not even yet completed.

Mr. *A. H. Campbell*, the Engineer and Surveyor to the Corporation of East Ham, was examined by Mr. RICHARDS, and taken through the various items alleged to have been expended on the roads, the gullies, the pumping out of basements, and the sewage works, &c.

In the course of a long cross-examination by Mr. MAYER, the witness admitted that, though the floods took place in June, 1903, the bulk of the road repairs was carried out in March and April of the present year. Work done immediately after the flooding was only temporary, and consisted of putting down a little ballast and doing some steam-rolling. An item for repairs to fencing, which was shown not to belong to the plaintiffs, was withdrawn.

Several other witnesses gave evidence as to the damage done and the repairs executed in various departments; among them being Mr. *Mackintosh*, the General Inspector and also foreman of constructional work, Mr. *Hawkes*, the Sanitary Inspector, who spoke as to the distribution of disinfectants after the flood, and Mr. *Carpenter*, the foreman of the sewage works, who described the damage done to the pumping plant. All these were cross-examined in considerable detail as to the actuality or necessity of the amounts expended.

Mr. *Fry*, the Borough Treasurer, was questioned upon the time-sheets and books of the plaintiffs, and his cross-examination was resumed yesterday (Monday), when the defendants' case was also opened.

It was arranged that the learned Referee should view the locality of the flood before giving his decision.

## HIGH COURT OF JUSTICE—CHANCERY DIVISION.

### Tuesday, Nov. 21.

(*Before Mr. Justice* FARWELL.)

### Corporation of Manchester v. New Moss Colliery Company, Ltd.

This was an action for an injunction to restrain the defendants from working minerals under lands adjacent to the Denton reservoir so as to injure it and other works of the plaintiffs.

Mr. FLETCHER MOULTON, K.C., Mr. E. JENKINS, K.C., and Mr. HUGH MOULTON (instructed by Messrs. Austin and Austin, for Mr. W. H. Talbot, of Manchester) appeared for the plaintiffs; Mr. NEVILLE, K.C., Mr. UPJOHN, K.C., and Mr. MACSWINNEY (instructed by Messrs. Bower, Cotton, and Bower, for Mr. H. G. Hall, of Ashton-under-Lyne) represented defendants.

Mr. MOULTON, in opening the case, read the statement of claim, which alleged that the plaintiffs were the owners of certain lands delineated on an annexed plan, and that the defendants had wrongfully removed coal and other minerals from certain lands situated near, and had thereby injured or destroyed the support to the lands, causing portions to sink, and damaging the reservoirs and other works; also that the defendants threatened and intended to continue the injurious acts. The statement of defence raised substantially two points—viz., that the greater portion of the lands in question were purchased by the plaintiffs from the Earl of Stamford, and that they were conveyed to them by a deed which expressly reserved the minerals to his Lordship and his assigns, with power to let down the surface without paying any compensation for injury. With regard to another small piece of land, called the Vicarage plot, it was alleged that the plaintiffs purchased it in virtue of the powers of the Water-Works Clauses Act, 1847, and that under the Act defendants, having given notice of their intention to work the minerals, and the plaintiffs not having offered to pay compensation, were entitled to work them; also that the defendants had purchased, under an agreement of November, 1900, from the plaintiffs, the coal in the Roger Mine, under the Vicarage plot. They also alleged that if any damage had been done, it was by workings more than 40 yards from the plaintiffs' land, for which they were not liable; that if the land had been left in its natural state, no damage would have ensued; and they denied any intention to act unlawfully. They also counterclaimed for compensation if they were liable for any damages for working under the Stamford lands at a greater distance than 40 yards from the plaintiffs' land. Counsel said he might summarize the defence by stating that every possible point was taken.

A model was brought into Court; the surface being an enlarged copy of the plan annexed to the statement of claim. The reservoirs themselves were coloured blue; other land adjoining, belonging to the plaintiffs, green; the portions where damage had already occurred were hatched in red; and a larger portion, where damage was anticipated if the defendants' works continued, were coloured plain red. On removing the surface of the model, the workings below were shown; the depth being from 1500 to 2000 feet.

Mr. MOULTON explained that there were two seams of coal—one called the Great Mine, and the other, some 20 feet lower down, the Roger Mine. The plaintiffs in 1900 sold to the defendants the coal in the Roger Mine under the Vicarage plot, and, of course, they could not complain of any damage which might have arisen from removing that coal; but they did claim to restrain the working of the seam on adjacent land so as to cause injury, and also the working of the Great Mine under the Vicarage plot. It appeared there was a considerable fault close by, which dropped both seams a considerable depth, and brought the Great Mine almost on a level with the Roger on the other side of the fault. The plaintiffs did not make any claim for damage to land they had purchased from Lord Stamford; but there was a considerable quantity of which they had the freehold, free from any restrictions, including the Vicarage plot and a much larger area purchased from a man named Taylor for which they claimed the right to support. Counsel then examined in detail the provisions of the Water-Works Clauses Act, and submitted that they gave no rights to adjacent owners beyond what they had at common law, but left them under the common law liability of not injuring their neighbour's land. He said their rights were preserved, but not enlarged; and they could not claim compensation under these clauses unless they would have been entitled to it otherwise. He thought the evidence would be conclusive that the making of the reservoirs had not had the slightest influence in producing the sinking which had taken place.

### Wednesday, Nov. 22.

On the resumption of the proceedings,

Mr. MOULTON commenced by describing the character of the danger to which embankments enclosing water reservoirs were exposed from any subsidence of the subsoil; a very slight injury which allowed the entrance of water being liable to cause the entire destruction of the work. He then proceeded to deal with the legal questions involved, and cited cases in support of the proposition he had advanced on the previous afternoon—that the Water-Works Clauses Act only provided for the payment to landowners of full compensation for any rights of which they were deprived, but with the additional privilege to the undertakers that they might simply acquire surface rights, postponing compensation for interfering with mineral rights or for severance until it was seen whether it was really necessary to interfere with them. There might, of course, be damage by severance to mines as well as to the surface; and this was provided for by the sections referred to. His case was that he was the absolute freeholder of Taylor's land, and the owner of the adjacent land had no right to let down the surface of it; and therefore he was not entitled to any compensation for not being allowed to do so. Having cited and commented on *Great Western Railway Company v. Bennett* and *Barclay v. Clayton*, the learned Counsel proceeded to call evidence.

Mr. *G. H. Hill*, the Water Engineer to the Manchester Corporation, was the first witness. He said the three reservoirs in question were known as the Audenshaw reservoirs, and were fed from the reservoirs which collected the water from a drainage area of 19,000 acres in the Longdendale district. He produced a plan of the district showing that the reservoirs supplied a very large area around Manchester. He said he was Resident Engineer, under Mr. Bateman, when the Longdendale reservoirs were constructed. The land coloured red had been for many years owned by the Corporation. The Gorton reservoirs, which were adjacent, were also fed from Longdendale, and were much older. They were found insufficient; and in 1877 the Corporation entered into a contract for the construction of the reservoirs in question. He was then Engineer to the Corporation, being a partner of Mr. Bateman, and superintended the work. In 1884, he made reports on the reservoirs, when the work was completed all but a little "dressing up." Witness put in a document showing the quantity and value of the work

* See "JOURNAL," Vol. XCI., p. 256.

done. In April, 1884, 99·9 per cent. of it was completed and paid for. The final certificate was given in May, 1885, when about £355 was the balance remaining. The soil was weak—chiefly boulder clay, with pockets of sand; and there were great difficulties in the construction. The site covered more than 250 acres; and there was hardly a waggon-load of gravel found. The high-water level was above the surface of the surrounding land; and the water was kept in by an embankment, which varied slightly in height. The highest point was 57 feet; the mean height being about 35 to 45 feet. The slope outside varied from 2 to 1 to 4 to 1; and on the inside from 3 to 1 to 5 to 1. On the top there was a stone wall 2 ft. 6 in. in height. In course of construction, there was considerable settlement of the embankment, but none of the ground underneath. For the last 22 years there had been no settlement requiring to be dealt with. Reservoir No. 1 had an area of 80 acres, and held 527,820,385 gallons of water; No. 2 held 371,011,000 gallons; No. 3, 542,477,000 gallons—that was to say, when it was full—and the top was 5 feet below the top of the embankments, as on this high plateau the wind caused considerable waves. The reservoirs had stood very well, not needing any repairs. In April, 1899, the Corporation received a letter from the defendants stating their intention to work the Roger Mine. In May, 1900, pegs were put down in the embankment 40 yards apart. Witness produced plans and documents, with black dots representing these pegs, which showed the subsidence which had taken place between May, 1900, and May, 1904; also between May, 1900, and October, 1904. One showed a difference of 1·91 feet. The pegs farthest from defendants' workings showed least subsidence. He attributed it to the coal workings, as there had been nothing of the kind during the previous twenty years. Another plan showed the subsidence since 1901; and another, a number of cracks which had been observed from time to time in the walls, amounting now to some hundreds. Similar cracks were to be seen in the wall bounding the Audenshaw Road, and in buildings all round. In one place, 7 or 8 yards of wall fell down. He attributed all this to subsidence due to mining operations. In some places, the flags of the footpaths had been disturbed. The subsidence was irregular, varying in extent in different places. In consequence of these injuries, the level of the water had been reduced by 8 feet. The result was that they lost 330 million gallons of water, and the district had to be put on a short supply. The reservoirs were watched night and day; for if a slip occurred, the Gorton reservoirs would also be destroyed, and the country inundated.

Cross-examined: He attributed the subsidence and the cracks to the mining operations because they did not occur before the workings took place. The embankments had not been in a weak condition all the time. There was constant trouble in forming the embankments; but there had been none since they were completed. Thousands of pounds were spent in making defects good during the progress of the works. A large quantity of burnt ballast was used, which was a very good material for the toe of the slope. The reservoirs were all ready for use in April, 1884, and two in 1883; and no repairs had been done since. Several extracts from the minutes of the proceedings of the Council were put to the witness, with the view of showing that the reservoirs were not completed as early as he had said; but he adhered to the statement that they were in use at the dates he had given, though there were trifling matters still to be completed. It would be a very expensive and a very lengthy business to repair the damage. It was ridiculous to suggest that £10 would cover the cost. There had been no leakage at any time. Between 1880 and 1884, he made numerous reports to the Water Committee as to the difficulties encountered in carrying on the work. The total cost of repairing the slips was upwards of £50,000, due to the character of the material which they had to deal with. One of the plans put in, showed a draw towards the workings.

Re-examined: The weather during the construction of these works was very unfavourable, considering the material they had to deal with. Notwithstanding the difficulties encountered, the work was quite satisfactory when finished. There was no doubt the reservoirs were practically complete early in 1884.

Mr. *G. H. Peace*, the Consulting Engineer to the plaintiffs, said he had advised the Corporation since the recent death of his father, with whom he was in partnership. He had visited the defendants' workings, and had caused the model of the surface and underground workings to be prepared. The collieries were in the north-east corner. The model showed the state of the workings at the end of 1904. The two shafts missed the seams of coal, owing to a large fault, and tunnels were cut to reach it. Witness explained the details of the model, and pointed out how the presence of what was called the "60-yard fault" brought the Roger Mine almost on a level with the Great Mine, and the mode in which the coal was worked—mainly, on the "long wall" system, but in some places on the "pillar and stall" method. The Great Mine was about 6 feet thick, and the Roger Mine about 5 feet. He had examined the plans of defendants' workings, which, he took it, were correct, and had prepared a plan from them showing the workings of the Great Mine at different times. A similar plan showed the workings of the Roger Mine. They indicated, as regarded the Great Mine, an intention to drive levels to the extreme boundary on the east of the fault, and then work out the coal between the pillars; and as regarded the Roger Mine, to work all out to the east of the 60-yard fault, and also on the west side by the "long wall" system. In his opinion, these workings had caused sinkings on the surface. They were visible to the eye. Witness produced several photographs showing cracks and injuries to buildings and walls (in one place, a wall had separated from the coping, leaving a space of 1½ inches) and pointed out the exact localities on the surface model. Subsidences generally occurred six or twelve months after the workings had taken place which caused them. If the workings were continued, as he gathered they were intended to be, they would cause further subsidence. Witness was then referred to the plans showing the pegs, and the extent of sinking which had taken place; and he said the subsidence was very serious, and was just what he should have expected. He had no doubt that what was shown would continually progress. Reverting to the photographs which showed both horizontal and vertical cracks, he said the horizontal cracks occurred where the wall was vertical over the workings. The vertical cracks were caused by a "draw;" the workings being not exactly underneath. In a deep mine like this, the subsidence was fairly, but not absolutely, even; and it only became approximately so when the whole effect had taken place. He was associated with his father in 1903 when the water-level was lowered, and approved of it. The presence of the 60-yard fault would prevent the subsidence being even. In a mine of this character and depth, the subsidence would probably extend for 400 yards towards the dip. The working out of the Roger Mine under the Vicarage plot could not have caused the depression he had spoken of; and it was a wise thing to do, because the existence of an isolated pillar like that would be rather an injury than a benefit. The presence of faults was an added source of danger, as they indicated a geological weakness, whereby a depression below might be communicated to the surface.

Cross-examined: None of the photographs were taken on places situated on the Taylor land. They referred to places either on the Stamford land or on property belonging to other people. The cracks had all appeared since 1900. There were some before then; but they were all plastered up. It was impossible to say how long it would be before a depression was seen on the surface. It would probably begin in about a year, and it might go on for four or five years before it was completed. The working of the Great Mine had probably had some influence in producing the subsidence; one could not separate it altogether from the working of the Roger Mine. He had not considered how far the subsidence was due to working within 40 yards from the reservoir, and how far to workings outside this limit. He thought it was due to both; but could not give the proportion due to each.

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**Thursday, Nov. 23.**

Mr. *Peace* was further cross-examined this morning. He said that the Audenshaw reservoirs were about 3 miles from the boundary of the city, and some 10 or 12 miles from the collecting reservoirs which fed them. He first observed a subsidence towards the end of the year 1900 on the Taylor land; and since then it had increased. The Great Mine workings did not at present affect the plaintiffs. He had made two inspections of the workings; and his assistant made a third. The working in the Roger Mine was properly carried on. Referring to the plans produced by Mr. Hill, showing the pegs, and the amount of subsidence, witness said the pegs, as a general rule, showed a gradual increase of movement in certain directions, and then a gradual decrease. If the workings in the Roger Mine were stopped now, there might be a serious fracture on the surface. The workings in that mine to the south of the Audenshaw Road were vertical beneath No. 1 reservoir; and he could not say that a stoppage of such workings would destroy that reservoir. Witness was cross-examined at considerable length as to the effect of workings more than 40 yards from the plaintiffs' boundary; but he adhered to the opinion that they were of considerable importance. He could not say whether he should advise the Corporation that they ought to pay compensation to the defendants under the Water-Works Clauses Act, in order to prevent damage to, or destruction of, the reservoirs. He repudiated the idea that the construction of the reservoirs had increased the liability to disturbance of the surface by underground workings.

Re-examined: Generally speaking, when a mine was worked on the "long-wall" system, the subsidence was fairly even; but not universally so. In the present case, the Roger Mine had been mainly worked on this system, and the subsidence had been irregular.

Mr. *J. G. Scott*, the Surveyor to the Water Committee of the Manchester Corporation, was the next witness. He said that, under the direction of Mr. Hill, he put in pegs, at a distance of 2 chains from one another, on the banks of the reservoirs, with a view to ascertain if any subsidence took place; and he described how it was done—levels being taken from an Ordnance bench mark on the Ashton Old Road, about half-a-mile from the works. In 1901, further pegs were put down, starting from the same bench mark; and this was repeated in 1903 and 1904. He verified the plans and tables put in by Mr. Hill, giving the results of the observations.

Mr. *W. H. Taylor*, the Estate Surveyor to the Water Committee, said that in 1896 there was a proposal to lay a drain in the Audenshaw district, and he took some observations in connection with it, and prepared a plan which he produced. He had this year drawn up another plan when the work was to be carried out. For these purposes, he took the level of the reservoir keeper's house, and found that it had dropped 11⅝ inches.

Mr. *H. Mattinson*, the Engineer to the Tramways Committee of the Corporation, said he found in 1904 the pavement between the tramway lines in the district in question taking a curved shape. He produced photographs showing how the pavement on one side had moved away from the rails, which were held in place by steel tie-rods. On taking up the rails to relay the pavement, he found they had sunk. This was on the bridge carrying the Manchester Road over the canal. He also found cracks in the abutments of the bridge.

Cross-examined: This was from 450 to 500 yards from the plaintiffs' red land. He was not aware whether this was on Lord Stamford's land.

Mr. UPJOHN said it was included in the defendants' mining lease.

Cross-examination continued: As far as he knew, there had been no interference with the road for gas or water purposes; but the Tramway Department had had to relay the whole of the pavement in the district, along the Manchester Road. The bridge, or close by it, was the nearest point of this road to the reservoirs.

Mr. *E. Bennett*, the reservoir keeper at Audenshaw, said he had lived in the keeper's house since 1883; the house was there when the land was bought in 1875. He noticed cracks in it in 1900, when the water began to come into the house. He had the cracks pointed up, and they had not re-appeared. Having described his duties, witness said he kept a diary, in which he noted the date when the pegs were put in—viz., April, 1900. On May 31, 1901, the cracks in the wall were pointed. He put a mark on No. 3 reservoir corresponding to the high-water level in the central well; and in 1904 he found that this mark had sunk 4 inches. He had also noticed that an island in No. 1 reservoir sank 2 ft. 10 in.

Cross-examined: He took the level by the height of the water which covered it, as shown by the gauge in the central well. His house was about 50 yards from the bank of the reservoir.

Mr. *J. H. Walker*, of the firm of Messrs. Walker and Rogers, mining engineers, said he had examined the surface land in question, and also the defendants' workings. He assisted in making the drawings from which the model was made. He had prepared a plan on the same scale as the model, showing the combined workings of the two mines, up to December, 1904. The Roger Mine was practically worked out. The Great Mine was laid out for working on the "long wall" system. On the plan he had marked the position of the pegs, and the extent of subsidence at each. The effects of the depression were plainly visible in many places. Under the bridge which had been referred to the towing path had sunk considerably; and the abutments of the bridge had been damaged, and had to be rebuilt. He had no doubt these effects were due to underground workings. He confirmed the previous evidence as to the surface depression extending a considerable distance beyond the area of the underground workings when they were on a slope. The extent varied from one-fifth to one-third of the depth. He produced diagrams showing the mode in which the depression spread —over flat and sloping seams extensively. The depressions on the surface were due to the defendants' workings. He went on to state in more detail the various portions of the workings which affected certain localities on the surface. The further working of the Great Mine to the east and north would cause more depression on both the hatched red and the plain red land. The subsidence was much more rapid in deep than in shallow mines; and it was so in this case. He anticipated that the injury to the surface would extend 400 yards to the dip beyond a vertical line drawn from the edge of the workings, about 200 yards to the sides, and about 30 yards to the rise.

Cross-examined: He agreed with a former witness that it was prudent on the part of the Corporation to allow the Roger Mine under the Vicarage plot to be worked, because the workings had been going on all round it, and there was no object in leaving this small amount of support, which would only add to the irregularity of the depression. Regular, continuous workings were most favourable for doing the smallest amount of damage to the surface. When workings were commenced, it would take some time, perhaps a year, before any effect was produced on the surface; but once the strata were set in motion, the depression would go on extending *pari passu* with the advance of the face of the working, but would extend beyond it.

Sir *Benjamin Baker* was the next witness. He said he had inspected the reservoirs and workings in question, and found it was in every respect a normal case of surface subsidence from underground operations. He described the wave of depression which took place when material was removed below the surface, The conditions and effects were well known to engineers; but it was impossible to devise a formula which would enable one to predict the results in any particular case. If experience were based on a few facts only, what would happen might confidently be predicted; but the more experience one had, the more impossible it was felt to say where or when a crack would occur. He could only say that the future stability of these reservoirs was seriously endangered by the defendants' mining operations. It would not be safe to keep them filled, because a crack might occur in a bank which would ultimately lead to a slip, and let the water out.

The witness was not cross-examined.

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**Tuesday, Nov. 28.**

On the resumption of the hearing of the case this morning,

Mr. *Bennett* was recalled, and produced some further books and documents, the entries in which showed the dates when the water was admitted to the reservoirs. It appeared from these that on April 26, 1884, the water was let into No. 1 from No. 3. Since then the water in the reservoirs had been in constant use; but it was not fit for consumption immediately, as it had to settle, which might take two or three months.

Cross-examined: The water was not taken into stock until it was fit for use. There was not sufficient water available to fill reservoir No. 1 for some time. In November, 1883, it contained 76,440,000 gallons, according to the gauge-book; its full capacity was 528 millions. On March 24, 1884, No. 3 reservoir had 251 million gallons in it. Witness was cross-examined in some details on these entries, to show the gradual manner the reservoirs came into use. Reservoir No. 2 was full on March 20, 1884. The depth of No. 1 was 27 ft. 6 in.

Mr. *J. W. Jones*, the principal assistant in the Engineer's department of the water-works, gave evidence to the same effect. He said the water in the reservoirs was treated as waste until it had settled, and become fit for consumption.

Cross-examined: On June 17, 1884, the depth of water in No. 1 reservoir was from 2 to 3 feet. When the 76 million gallons were taken into stock in November, 1884, they were at the end of a severe drought, and there was a question of putting the consumers on short supply. Otherwise, so small a quantity would not have been taken into stock. The reservoir was quite ready for water; but they could not fill it owing to the drought. He could not agree that the Woodhead reservoir was never full between March, 1883, and May, 1885. In April, 1884, both that and Tawside reservoir were full to within 5 feet of the top. They always allowed the 5 feet to provide for occasional floods.

Mr. *J. Wallis*, a land agent and surveyor of Manchester, said he had had large experience in dealing with land in the district. He knew the locality well, and had been over it for the purposes of this case. The land coloured red was about 17 acres, and a great portion of it was occupied by the reservoirs. Some 4 acres were not so occupied, and were very valuable for building purposes. It was about 4 miles from Manchester, and was very accessible.

Mr. NEVILLE remarked that he did not see the necessity for this evidence. He admitted that if his friend were right in his legal contention, there must be an inquiry as to damages.

Mr. JENKINS thought that the only remaining point on which he need call evidence was that of title. To prove strictly his title to every part of the land coloured red would involve the examination or 35 or 40 deeds; and he proposed to put in only a few, showing the title to the main portion of the land in question.

Mr. NEVILLE said this was a matter which would occupy a great deal of time; and he would suggest that his friend should show the deeds to the advisers of the defendants, and they should examine them and see if they desired to raise any question of title.

Justice FARWELL thought this a very reasonable course to adopt.

Mr. JENKINS said he should address his Lordship very shortly in summing up the plaintiffs' case, as he did not think there would be any real dispute as to the facts. His case was simply that he was a landowner, that the defendants were mining under adjacent land—not trespassing on his property—and by so doing were letting down the surface. It was no part of his case to distinguish between the land and the buildings upon it; but there were buildings, and they were damaged, and this was part of the damages he was entitled to recover. He understood that the defendants were going to set up the contention that the buildings put on the land had contributed to the subsidence; and if they succeeded in this, there might be a question as to the length of time they had been there, in order to establish some kind of easement, under the Prescription Act, or otherwise. At present, however, he did not propose to go into the question, because he submitted that the onus would lie on the defendants to establish that the buildings had contributed to the subsidence. He relied on the natural right to the support of the adjacent land, which was not an easement at all. To let down one's neighbour's land was actionable *per se*; and the proof of damage was not necessary. But if it were proved, one could bring in the damage to the buildings as part of the natural consequences of the wrongful act. If it were once shown that the subsidence would not have taken place but for the buildings, then the plaintiffs were driven to show that they had an easement for the buildings, but not until then. Evidence was clear that there had been a subsidence of about 2 ft. 6 in.; and the engineers said it would go on to the extent of between 5 and 6 feet. Perhaps the more important point was the one which he gathered was to be set up under the Water-Works Clauses Act. It seemed to him that they must either say that the plaintiffs did not, in their conveyance for Taylor, get such rights of support as his land then enjoyed as against his neighbours, or that, though they then secured these rights, they were in some way taken away by the Water-Works Clauses Act.

Justice FARWELL thought Mr. Jenkins had better let Mr. Neville develop his own case before answering it; otherwise he might suggest to him some point he had not thought of.

Mr. JENKINS, after some further discussion, and having briefly referred to one of the cases, acceded to his Lordship's suggestion, and concluded by saying that he asked for an injunction to restrain the working of the mines so as to let down the surface, and for an inquiry as to damages.

Mr. NEVILLE, in opening the defendants' case, said there might be one or two minor points requiring discussion; but these he did not intend to go into until all the evidence had been given. He would deal with the main question in the case, which was one of law—viz., what was the true construction of the Water-Works Clauses Act, 1847. The authorities were numerous, but all, when rightly understood, led to one conclusion—viz., that the Railways Clauses Act of 1845 and the Act in question, which were to be treated as substantially similar, introduced with regard to railway and water-works undertakers a code which was not an addition to the common-law rights of landowners and undertakers, but a substitution for those rights; the Act of 1847 going rather farther than that of 1845. He did not think it mattered whether the land was taken compulsorily or by agreement, or whether the surface alone was purchased or the surface and the minerals. The Act of 1847 did not draw a distinction between a mine-owner who had sold his surface to water undertakers and any other mine-owner. The railway and water companies obtained a great privilege from the Legislature by the Acts named, because it enabled them to acquire the surface of the land only, without purchasing the minerals beneath, until it was seen whether it was necessary to do so. It also gave them power to fix a limit within which minerals might be worked; and if no limit were fixed by the Special Act, the limit was put at 40 yards. In return for these privileges, the undertakers gave up their common-law rights as to support from the adjacent land; and unless they gave notice, and agreed to pay compensation, the mine-owner was entitled to work out his minerals. If he did so, in the usual and proper manner, he might even let down the surface. Plaintiffs contended that they had their common-law rights, *plus* the rights given them under the Act; but if this were so, they obtained a great advantage without giving any consideration for it. He thought the authorities showed that, apart from any special bargain, both railway and water companies came within the code provided in the Acts of 1845 and 1847, and had no rights except those thereby conferred upon them. This was the real question at issue between the parties; and he believed the authorities were conclusive on the subject. The learned Counsel then proceeded to quote at considerable length from previous cases, among them being that of *Holliday v. Mayor, &c., of Wakefield*,* in which it was said by more than one of the Law Lords that the mining sections in the Act constituted a complete code of the rights of mine-owners and undertakers of water-works. He then went on to consider whether the authorities he had cited were any the less applicable in a case where the land was not acquired under compulsory powers, and he submitted that they were not. He next referred in some detail to the various Acts under which the plaintiffs were empowered to acquire, maintain, and extend the water-works, and read the principal parts of the conveyance from Taylor to them, in July, 1875, of the land that was coloured red on the plan. This no doubt included the minerals, though it looked as if they had slipped in among the other general words. The conveyance by Lord Stamford in January, 1875, reserved to the Earl and his assigns all the mines and minerals, but subject to the provisions of the Water-Works Clauses Act. In both conveyances there was a clause stating that the purchase-money was to be taken in full discharge of any damage caused by severance, or injury affecting the other lands.

* See "JOURNAL," Vol. LVI., p. 1296.

### Wednesday, Nov. 29.

Mr. NEVILLE continued his argument this morning, and cited several other cases with the object of showing that, though a water company might take both surface and mines, their rights were still regulated by the Water-Works' Clauses Act, and these rights were in substitution of any others with regard to the support they might otherwise have had. He further submitted that the fact that this land was taken by agreement, and not compulsorily, did not in any way affect the question.

Mr. *John Higson*, of Manchester, was then called. He said his firm had for many years been Mining Engineers to the Earl of Stamford and his Trustees. He had been down to every seam of coal that had been worked in the Ashton district for the last forty years, including the mines in question in the present action. For many years he had charge of the Dukinfield Collieries, which were adjacent to those of the defendants, and there worked the Great and Roger Mines. There were within the district streets of valuable property which the working of the mines would affect. From his experience, he should say that from twenty months to two years was the time within which subsidence on the surface would take place from such workings. The deeper the mine, the longer it was before subsidence on the surface was manifested. With regard to the direction of the disturbance, he should take a line at right angles to the inclination of the strata; and from the point where it struck the surface he should put the extension of the effect at one-fourth the depth of the workings. This would include a margin of safety. As a general statement, he agreed with Mr. Walker's evidence as to the extent of the influence on the surface, except that he did not think the actual subsidence would extend quite so far. The 20 to 33 per cent. mentioned by Mr. Walker would include a very good margin of safety. These figures referred to workings to the dip. For workings on the level course, off the dip, he should allow a lateral margin of 25 per cent., which in this case would be 160 yards instead of the 200 yards which Mr. Walker gave. In his experience, 160 yards would be ample. In working mines at great depth, the subsidence of the surface was very gradual in character; varying according to the strata. He knew of hundreds of thousands of acres which had gone down 8 or 9 feet, and express trains were running over them, and no ill-effect was felt. He had examined the plaintiffs' works and the surrounding property, and he could not see any damage to the reservoir. In his opinion, more damage would accrue by the stoppage of the works than by allowing the coal to be taken out regularly. If the Roger Mine were allowed to be worked in one continual progress under the water-works, he did not think any material damage would occur. He was not so sure about the Great Mine, which could not be worked so successfully on the "long wall" system. If both of these mines were worked under the reservoir, the probable effect would be that it would subside to the extent of 60 per cent. of the thickness of the two seams. He had calculated the loss which would be sustained by the defendants were an injunction granted preventing them working so as to affect the support to the Taylor land. In the Great Mine there would be a loss of royalty of £34,800; and in the Roger Mine of £28,250, or a total of £63,050. To this he should add, for severed pieces of coal which could not be worked, £2650. This made a grand total of £65,700 loss of royalty to the lessor if the reservoir were to be protected by pillars of coal on the 25 per cent. basis. There were other mines under these, which he had worked from the same shaft, on which the royalty was £30 instead of £25 per acre; and this would eat up £89,000, or a total of £155,000. Besides, there were at least half-a-dozen seams generally recognized as good ones which would certainly be worked eventually if the owners were not restrained. So that, in fact, the figures he had given might be doubled; and he should say that Lord Stamford would eventually lose £300,000 in round figures. Allowing the lessee 1s. a ton as fair profit, he would lose double this amount, or £600,000. Witness produced a plan which he had prepared showing the extent to which Lord Stamford's mines might be worked if the plaintiffs were entitled to have a sufficient pillar of coal left to support the land coloured red. It was on this basis that he had arrived at the figures just given. In his opinion, the result of leaving such support and working only the rest of the coal would be to produce a greater depression under the centre of the reservoirs, and there would be more tendency to interfere with the stability of the banks.

In cross-examination, witness stated that, taking the lateral spread of the subsidence as one-fourth of the depth in a depth of 600 yards, the lateral spread would be 150 yards. But a considerable portion of this would be a margin of safety. He put the lateral spread at 110 yards. Witness was then cross-examined in some detail with regard to the evidence afforded by the pegs; but he repeated that, in his opinion, the plaintiffs' witnesses put the subsidence rather too far. It was most important to the defendants and to Lord Stamford that they should be able to let down the Taylor land. In arriving at the figures he had given, he had taken the areas of the coal required to be left, and reckoned the amount of royalty; it had nothing to do with the present price of coal. If the defendants were prevented from working this coal, Lord Stamford's estate would suffer to the extent of £150,000. He afterwards doubled this for the coal at greater depth. But the £300,000 was not the present value; it was the ultimate value to the lessor. The lessee would get about twice the amount on the basis of 1s. a ton profit. Hitherto the Company had worked as they pleased; and to his mind the subsidence had been exceedingly regular. He did not dispute that working 40 yards outside the works would cause a subsidence. To get the greatest amount of evenness of subsidence, the coal under the plaintiffs' land must be worked regularly. He did not think there would be any difficulty with regard to the water-pipes if the whole reservoir sank, though he was not a water-works engineer. It was not a fact that none of the other mines he had referred to had been opened out. He worked two himself for years—the Saltpetre and Black Mines. He did not admit that these were abandoned because they would not pay. He had always insisted that they ought to have been worked; and he still did so.

Re-examined: The whole of the other seams of which he had taken account in his calculation were some which he had himself worked at Dukinfield. There were very heavy pumping expenses; and this led to the seams being closed. He did not consider the pegs showed any material irregularity.

Mr. *H. S. Child*, a mining engineer of Wakefield, agreed with the last witness that it would be approximately two years from the date of working before any effect began to show itself on the surface. He was inclined to agree with Mr. Higson rather than with Mr. Walker as to the lateral spread of subsidence; but he did not think there was much in it. On the whole, he was of opinion the subsidence was regular. He had carefully considered the extent of the barrier which would have to be left to support the red land, if the plaintiffs were entitled to it, and how much of Lord Stamford's coal could be worked if Taylor's land was very fully protected. The plans put in by the last witness (for which he was jointly responsible) made a very liberal protection. He considered that if this protection was afforded, and the rest of the coal worked, it would have a very great effect on reservoirs Nos. 1 and 3, and it would cause a serious break in the banks.

Cross-examined: From what he had already said, it followed that all the subsidence, as at present seen, came from workings at least two years old. The puzzle was that in 1900 there was damage done; and he could not find any working in 1898, or even in 1899, that could have caused it.

Mr. *Charles Hawksley* was the next witness. He said that on Dec. 7, 1904, he visited the Audenshaw reservoirs, and went completely round the embankment of No. 1, and carefully inspected it. At that time the water was 26 feet below the top level; and there were indications of subsidence in the wall round the top of the embankment such as had been described. There was no serious injury to the reservoirs, which were all perfectly water-tight. He agreed that it was a wise precaution to lower the water in the reservoirs when it was found there was a subsidence; but it appeared to him unnecessary to lower that which was in No. 3 more than from 1 foot to 3 ft. 6 in. He did not understand why the difference should have been made between the one and the other. He did not think it would follow that the reservoir would cease to be water-tight in consequence of this subsidence. He knew of instances where coal had been taken out, and the reservoir had remained completely water-tight. If the coal was not taken out regularly over the whole area, there would be much more risk of injury.

Cross-examined: Mr. Hill was a very experienced water engineer, and he had no doubt that he did what he thought was the best under the circumstances.

This concluded the evidence for the defendants.

Mr. UPJOHN then commenced his address in summing up the defendants' case.

### Thursday, Nov. 30.

Mr. UPJOHN resumed his address this morning, and concluded shortly before the midday adjournment. The time was mainly occupied with technical legal arguments, and the citation and discussion of numerous authorities.

Mr. MOULTON then commenced his reply, in which he dealt at great length with the arguments and authorities put forward by Mr. Neville and Mr. Upjohn. He again submitted, as he had done in opening the case, that the Water-Works Clauses Act in no way restricted the rights which the plaintiffs enjoyed by reason of their ownership of what had been called the Taylor land.

### Friday, Dec. 1.

Mr. MOULTON resumed his speech in reply (after other business had been disposed of) about midday, and at four o'clock he had still some points left to deal with.

The further hearing of the case was adjourned till to-day (Tuesday).

## New Premises for the British Gaslight Company at Hull.

Last Friday, the new premises which the British Gaslight Company have taken in King Edward Street, Hull, were opened with a very fine show of gas fittings and appliances, arranged under the supervision of Mr. John Young, the Company's Engineer and Manager at Hull. A conspicuous feature of the display is the inverted incandescent gas-light. The interior of the shop, which has been handsomely decorated, is lighted chiefly by 300-candle power lamps, which, when burning four hours, only cost 1d. each for gas. It is intended to have outside two high-pressure lamps of 4000-candle power. There is on view a choice selection of gas cooking-stoves, gas-fires, hot-water radiators, &c. The basement of the premises is being used for workshops and stores. There will be, in addition, a large show-room on the first floor. Two other rooms at the top of the building will accommodate stock. Mr. Perkins has been appointed Manager of this department of the Company's business.

**Municipal Building Extensions at Birmingham.**—At a special meeting last Tuesday, the Birmingham City Council agreed to a scheme for providing additional municipal offices and an extension of the Art Gallery on land on the north side of Edmund Street. The outlay is expected to be about £150,000; but as the trading Committees will bear their due proportion, the cost to the rates is not expected to be more than £95,000. The new building will accommodate, among others, the Gas Committee; the present gas offices being given up to the Water Committee.

**Electric Lighting of Torquay.**—The Local Government Board, in a letter received by the Torquay Town Council last week, sanctioning a loan of £8099 for extending the electricity station, take the opportunity of giving the Corporation some advice on the subject of the lighting of the town. The matter was alluded to at the public inquiry held in reference to the loan. It is now pointed out that it is desirable to postpone for the present any extension of public lighting by electricity. The Board gathered that this system was unremunerative; and it was inadvisable to increase the existing load for any unprofitable purpose.

# MISCELLANEOUS NEWS.

## IMPERIAL CONTINENTAL GAS ASSOCIATION.

### Proposed Capitalization of the Amount Appropriated for Contingencies.

In the general strength of gas stocks lately, the stocks of the Imperial Continental Gas Association have been conspicuously buoyant, and have made some exceptional advances. Explanation is found in the following circular received from the Secretary of the Association, Mr. R. W. Wilson :—

"My Board of Directors have had under consideration, for some considerable time past, the question of utilizing powers conferred upon them by Act of Parliament to capitalize the sum appropriated from profits to meet contingencies, &c.

"At the general meeting to be held in May next, my Board intend, subject to the results of the current half year, to submit to the proprietors the following proposal.

"To capitalize the amount appropriated to meet contingencies, to an amount equivalent to 30 per cent. of the present capital, raising the capital from £3,800,000 to £4,940,000, and to divide such extra amount of capital—namely, £1,140,000—among the proprietors.

"My Board further wish to point out that, if the proposal be adopted, the rate per cent. of dividend will be reduced, as on a previous occasion when a division of capital was made. They will propose a reduction to 8 per cent. on the increased capital of £4,940,000. This dividend of 8 per cent. will necessitate the distribution of £15,000 per annum more than the sum now divided, and will increase a proprietor's income by the sum of 8s. per cent.—*i.e.*, £100 of present capital stock brings in £10 per annum ; £130 stock at 8 per cent. will bring in £10 8s. per annum."

## GAS v. ELECTRICITY IN THE CITY OF LONDON.

### The Lighting of Lower Thames Street and Monument Street.

At the Meeting of the Court of Common Council of the City of London last Thursday, the Streets Committee brought up a report relative to the scheme agreed to on the 4th of May last for lighting Lower Thames Street and Monument Street by means of high-pressure gas-lamps, and submitting a plan from the Engineer for extending the improved lighting at an increased initial cost of £135 6s. The Committee also submitted for adoption an arrangement for further modifying the scheme by removing the three small refuges in the centre of the carriage-way in Monument Street, and the two existing circular refuges opposite Billingsgate Market, and substituting (at an estimated cost of £40) an oval-shaped rest, on which it is proposed to fix one 900-candle power high-pressure lamp in lieu of the two previously agreed upon ; thus reducing the annual charge for gas lighting under the original scheme by £18 2s.

On the motion for the adoption of the report, Mr. Millar Wilkinson moved, as an amendment, that the matter should be referred back to the Committee, pending the completion of the present experiments in high-pressure gas lighting. He declared that Mr. Morton was biased on the subject of gas lighting for street purposes, and exercised far too much power on the Streets Committee. The City of London Electric Lighting Company had been asked to remove their standards from the streets before the results of the present experiments were known, and in this and many other ways they had not been fairly treated. He could not understand why the Company should not have a chance of competing on equal terms with gas. Mr. White inquired whether the Company had been afforded an opportunity to replace their old lanterns with lamps of a more improved kind. If not, he thought that, in common fairness, they should be given some opportunity of improving their apparatus. Mr. Sayer (Billingsgate) assured the Court that all who were doing business in and around Billingsgate Market were thankful to the Streets Committee for the improvement that had been made in the street lighting of the locality. Mr. Saqui said the Electrical Engineer had stated that, if the Electric Lighting Company were permitted to adopt up-to-date apparatus, the Gas Companies could not compete successfully with electricity, while at the same time there would be a saving of the ratepayers' money. He thought that if new electric lamps had been introduced into the Fleet Street lighting, the illumination of the street would be better than it was now. Mr. Wallace urged that the Electric Lighting Company should be allowed to do what they could in Lower Thames Street. In the course of the discussion, one councillor said he had noticed that electricity had more penetrative power than gas in fog ; but the statement was greeted with cries of "No, no."

The Chairman of the Committee (Mr. A. C. Morton) said the question of what light should be generally used in the City for the streets did not arise on the report before the Court. Later on, however, this matter would have to be decided. The lighting of Lower Thames Street and Monument Street with high-pressure gas-lamps had been resolved upon by the Court ; and the present recommendations were simply an improvement on the orders then given. As a matter of fact, all the Streets Committee were now doing was carrying out the instruction of the Court ; and the Committee were practically unanimous in making the recommendations. There was no doubt as to the success of high-pressure gas for street lighting in the City. The arc lamp was a failure. It wobbled, it glared, and it went out. It was not, to put it in the mildest possible way, a success. With gas, the City was now getting about four times the light for the same money as was being paid before for electricity. It was asked to give the Electric Light Company the opportunity of putting up better lamps. But it must be remembered that they had had such an opportunity in the past and had not availed themselves of it. The present electric lights at the Mansion House were an absolute failure. The way they glared in comparison with the soft light of gas was very noticeable. The object of the Streets Committee was not to aid any company, but to make the City of London the best-lighted city in the world.

On a show of hands, the amendment was lost, and the Committee's recommendation was carried by a large majority—only four voting in favour of electricity.

## THE ELECTRIC LIGHTING AT MALTON.

### A "Breeze" in the Council.

The step taken by the Malton Urban District Council in transferring their contract for the street lighting from the Gas Company to the Northern Counties Electricity Company, is proving anything but a satisfactory one, either to the ratepayers at large or to the Council. At the monthly meeting of this body on Wednesday last, a lively "scene" occurred between the Chairman (who, as our readers may remember, is Mr. Henry Tobey, the Engineer and Secretary of the Gas Company) and one of the members—Mr. William Plowman—who is prominent among the supporters of electric lighting on the Council and in the town itself. It appears to have come to the knowledge of the Chairman that the Surveyor to the Council (Mr. R. Richardson) had accepted a fee, or fees, from the Electricity Company for work said to have been done by him in the laying of the cables in the town. In consequence of this, he gave notice, at the October meeting, that he would bring the whole question before the Council, in order to consider their position in the matter. Mr. Tobey, however, explained on Wednesday that in the interim the matter had been brought before the Public Auditor, who had surcharged the Surveyor, and he was now appealing to the Local Government Board against the surcharge. Under the circumstances, therefore, the Chairman said he did not wish to proceed at present with his notice of motion.

On this announcement being made, Mr. Plowman began to attack Mr. Tobey and also Mr. Hugh W. Pearson, the Chairman of the Gas Company, who, he said, had sent some complaints to the Committee, making attacks on their Surveyor. He demanded that these letters should be read in open Council, while the representatives of the Press were present. The Chairman told him he was out of order, as there was no motion before the meeting. Mr. Plowman, however, pressed his demand, and the letters were read. They pointed out to the Committee that, by accepting a fee from the Electricity Company, the Surveyor had practically put himself into the position of their paid servant, and that therefore his reports on the electric lighting and the way the Company were carrying out their work could not be accepted as independent and reliable. Mr. Pearson (who is a Solicitor and a large private ratepayer in the town) gave many instances of negligence and defects in the lighting arrangements, and said the lamps altogether were "mere glow-worms," and totally inefficient for lighting purposes.

Having got the letters, Mr. Plowman next wanted to comment upon them, and, as he said, protect the Council from the reflections of Mr. Pearson. But the Chairman again interrupted him ; telling him he was altogether out of order, and requesting him to sit down. The Clerk ruled that if Mr. Plowman wanted to raise the whole question he must give notice of motion and bring it forward at another meeting.

## LIGHTING OF NEW YORK CITY.

### Recent Improvements.

Two of the daily papers of New York have lately devoted some space to the subject of the improved lighting of the city. In October, the "New York World" came out with a flowery article giving a number of interesting statistics, from which we make a few extracts.

It appears there are altogether 15 million gas and electric lights in the city ; and a sum of $50,000,000 is paid to "conquer the darkness of the night." In its five boroughs, New York has 2852 miles of streets, which are lighted by electricity, gas, and naphtha. Within an hour after the sun goes down, the gas-lamps along 900 miles of streets and avenues are lighted by 300 boys ; and from the central power stations the turning of a lever brings into illumination the thousands of electric lights located over many miles of the city's area. The city's bill for lighting its streets, public buildings, parks, bridges, and wharves, is $4,000,000 a year. Indoors and out, it is estimated that there are 5 million electric lights in the greater city ; and this number is increasing at the rate of 50,000 monthly. Every 24 hours, 100 million cubic feet of gas are burned. This serves 10 million lights, and brings a revenue to the Companies of $100,000 a day. Where gas-mains do not reach, in some streets and parks of the greater city, naphtha lights are burning. In recent months, the main avenues of the city which were not already so favoured have been provided with "white-light" gas-lamps ; and now more than 40,000 of these mantle-burners illuminate the avenues. This burner, the writer of the article says, "saved the situation" for gas as an illuminant in competition with electricity.

The "New York Herald" devoted the greater portion of a page of its issue for the 12th ult. to the subject of public lighting, giving a number of illustrations produced from photographs. As usual, the most conspicuous features are the head-lines, which run : "Solving the Problem of Lighting New York Streets. About 22,000,000 candle power ; cost, $2,000,000 a year ; number of lights, 65,000." Gas was introduced into New York in 1821 ; and the square street-lamps then employed, which gave the light of about 12 candles, remained in use till 1882, when the electric light was adopted. Now the old lamps, about 17,500 in number, have disappeared, and new ones of five times the power, on the incandescent system, have been substituted for them. Last summer, in the streets of Manhattan and the Bronx, there was a total light equal to more than 1¾ million candles. It is hoped next year to get rid of the old open flame naphtha lanterns, and to properly light the great parks. The extension of incandescent gas lighting

throughout the boroughs of Brooklyn, Queen's, and Richmond is also contemplated as fast as the city can arrange to do it. In the borough of Manhattan are shown the best example of the artistic improvements of the lights and lamp-posts. Careful study and systematizing the general lighting of the city, the tendency toward increased and better illumination, the improved appearance of the lamp-posts, &c., that has been shown in the efforts of both the city and its lighting contractors make it fair to assume, in the opinion of the "Herald," that if this is continued persistently and intelligently, within a very few years New York will be one of the most beautifully lighted cities in the world.

## MUNICIPAL TRADING IN AMERICA.

### Disastrous Results of Electric Lighting.

Reference has been made from time to time in the "JOURNAL" to the work of the Industrial Freedom League. We have recently received from the Secretary (Mr. P. S. Bridgeford) the following interesting particulars in regard to municipal trading in America.

The agitation which has been carried on in the United States for the municipalization of public utilities has caused the "Terre Haute (Ind.) Morning Star" to collect data of the results attained by various cities which have carried on electric lighting and other undertakings. They show unmistakably that many cities owned electric lighting plants which proved disastrous failures, and have sooner or later been abandoned, or, if still carried on, the cost per lamp per annum is greater than would be the case if current were furnished by private companies. From the synopsis of a portion of the data published, it appears that of the 61 towns dealt with, 26 have abandoned municipal ownership, and have either disposed of their plant at a ruinous figure, or have abandoned it altogether.

The provision of a sinking or depreciation fund does not appear to enter into the financial arrangements of many American cities. At Detroit, the plant cost in 1895 a sum of $650,000, and $175,000 have since been added to the investment account. The plant is insufficient and out-of-date; and as there is no money in hand to pay off the bonds on the original plant, the citizens generally oppose the new installation.

A Committee who have reported on the Columbia City (Ind.) water and electric light undertakings find that the latter has been running into debt during the seven years it has been in operation. At Columbus (Ohio), the report of the Committee who investigated the municipal lighting plant shows the cost of lamps to be $98 a year; but the city only pays $74·50 for lamps lit by private companies. The report covers a period of four years and a half; and the plant is abandoned as a "monstrous extravagance." It was said to be worth $68,000; but last December interest was being paid on $300,000 of bonds issued; so that the experiment has been a costly one for the ratepayers.

An investment of $1,750,000 in electric lighting and water plant was made by Austin (Texas); an immense dam being built across the Colorado River. Shortly after the plant started, the dam began to leak, and it finally burst; destroying not only the entire plant, but causing a loss of more than $3,000,000 to property in the city. Before the municipal plant was established, the tax was 90 c. per $100; but it is now $2·30. The electric light experiment at Braintree (Mass.) has raised the tax levy from $17·20 to $20·40 per $1000; and at Needham (Mass.), from $12·60 to $17.

When the citizens of Hamilton (Ohio) were asked to undertake the supply of water, gas, and electric light, they were assured that the plant would not cost more than $50,000. They have invested $755,000 in the service, and the State Examiner reports that the plant is a failure. The annual interest on the bonds takes 90 per cent. of the entire revenue of the city.

About ten years since, Toledo (Ohio) established a municipal gas plant, and borrowed $1,500,000 for the purpose. Three years ago the plant was sold for $102,000; and the city authorities are defending a lawsuit brought against them by the purchasers to recover $27,000 of the price, as 3½ miles of pipe which they paid for did not exist.

At Marquettee (Mich.), a loss of nearly $75,000 has resulted from the electric light undertaking. At Elgin (Ill.), the plant which cost $255,000 was operated for sixteen years, and was abandoned after sustaining a loss of upwards of $100,000.

The electric lighting plant at Crawfordsville (Ind.) was to cost $32,000; but it actually amounted to $105,000. When the cost per lamp had increased $116 per annum, the taxpayers demanded that the plant should be sold. Persistent efforts were made to find a purchaser; but no one would offer more than one-third of the amount which had been expended, and attempts to lease the plant were unsuccessful.

At Cherubusco (Ind.), many influential citizens opposed a municipal electric light system; but they were defeated by the non-paying voters. The undertaking was a failure; and when the bonds became due, there were no funds to pay them off. The plant was accordingly sold to a private company. At Mishawake (Ind.), the plant was sold under similar circumstances. The results of municipal ownership at Webster City caused such an increase in taxation that the citizens came to the conclusion, after twenty years of faithful experiment, that the system could not be a success; and the city repudiated it by defeating every municipalization candidate.

"The shrewd citizens of the United States evidently believe in cutting their losses," even if the results are sometimes rather disastrous. At Xenia (Ohio), plant which cost $35,000 was sold, after fourteen years' use, to a private company for $2500; at Gravesend, plant which cost $120,000 was operated for a few years, and then sold to a private company for $31,000; at Bowling Green (Ohio), where the interest during ownership was always paid out of the taxes, plant which cost $47,000 was sold, after four years' operation, for $12,000.

The Superintendent of the Allegheny (Penn.) undertaking, on which a sum of $416,200 has been expended, has notified that the plant is obsolete and dangerous to use, and that it would cost $100,000 to put it in proper condition; while at Lansing (Mich.), where the lamps cost $101·20 per annum, the Mayor has declared that the city is really engaged in wholesale larceny.

## HALIFAX WATER-WORKS EXTENSIONS.

### The Supply of Morley and Ossett.

Mr. W. O. E. Meade-King had to listen to a lot of opponents when, on behalf of the Local Government Board, he attended at Halifax to hold an inquiry into an application by the Corporation for sanction to borrow £32,040 for water-works purposes. Of the sum named, £22,040 was required for laying an 18-inch additional main from the Albert reservoir, Halifax, to Clifton Bridge, Brighouse. There are already two mains to Brighouse, through which 500 million gallons of water pass. Mr. J. A. Paskin, the Consulting Water Engineer to the Corporation, stated that if the proposed main was not laid, the Corporation would be unable to fulfil their statutory obligations. If it were laid, there would be a sufficient supply for thirty years for Brighouse and the districts through which the main would pass, in addition to what it was proposed to sell to Morley and Ossett. Numerous complaints had been received of shortage of water under the existing conditions. Mr. E. Haley, one of the half-dozen or so opponents who took part in the proceedings, said that, but for the desire to supply water to Morley and Ossett, there would have been no necessity for new pipes to be laid to Brighouse. He objected that the town should be burdened with the cost of providing water to these outlying districts unless the latter paid an adequate price for it. Every 1000 gallons of water cost Halifax 6d. Morley would be supplied at 5d. per 1000 gallons; but by Halifax foregoing half of a water royalty, the price was reduced to 3½d. After interest and sinking fund for the main had been deducted, Halifax received 2½d. per 1000 gallons. It was not right that ratepayers should be compelled to pay from 6d. to 8d. per 1000 gallons, with a rate-in-aid for the water-works of 30 per cent., and then have water sold outside the borough at the price it was. The Town Clerk, in reply to Mr. Haley, said that the price for several districts was fixed by Act of Parliament; but this was not so in regard to Morley and Ossett. Mr. James Parker, the Chairman of the Water-Works Committee, stated that an accountant in the town gave the cost of water to Halifax, apart from Walshaw Dean, as 3d. per 1000 gallons. He (Mr. Parker) gave it as slightly over 4d. at the Albert reservoir. At the end of twenty years, Halifax would be £70,000 in pocket in receipts from Morley and Ossett for water. A corporation constructed reservoirs for the future, and did not require the uttermost drop from the moment they commenced to use a reservoir. The water that would be sold to Morley and Ossett would otherwise run down the stream to waste. The Town Clerk said that at one time the charge for water to outsiders was 6d. per 1000 gallons. The Halifax Corporation asked Parliament to increase it; but they got such a "slap in the face" that Hebden Bridge at the present day obtained their supply at 3½d. per 1000 gallons.

## THE WATER SUPPLY OF PARIS.

### Projected Improvements.

For some time past, considerable dissatisfaction has been felt at the condition of the water supply of Paris, and during the last few years quite a campaign has been carried on by the "Matin" against the authorities who have control of it. Whenever, owing to a falling off in the available spring water, it has been necessary to turn on a supply from the Seine, our enterprising Parisian contemporary has had the city placarded with bills calling upon the public to boil the water. The result of the persistent attacks on the officials has been the resignation of two, if not three of them, and a very manifest movement in the direction of reform. A few days ago, a report was presented to the Municipal Council by M. Ernest Moreau, in which a reorganization of the supervising departments connected with the water supply was urgently demanded; and the Council were asked to adopt a proposition calling upon the Administration to submit a suitable scheme. At a subsequent sitting, the matter was again referred to by a member, who drew from the Prefect of the Seine the statement that a report dealing with the measures necessary to considerably increase the supply of water to the city had been drawn up and submitted to the Committee presided over by M. Moreau. Our contemporary gives an outline of this report, and from it the following particulars are taken.

The quantity of river water furnished daily will be increased by 194,280 cubic metres (1 cubic metre = 220 gallons), made up as follows: From the Marne, filtered, 65,280 cubic metres; do., raw, 29,000 cubic metres; and from the Seine, unfiltered, 100,000 cubic metres. Half the Seine water will be sent to the reservoirs at Ménilmontant, and the other half to the one at Villejuif. These reservoirs furnish the supply of river water to the higher parts of the city. The filtered water coming from the tanks at Ivry, now in course of construction, will go to augment the water of the Avre stored in the reservoir at St. Cloud. These improvements will necessitate the carrying out of three series of works—viz., the enlargement of the existing pumping plant, the laying down of new trunk mains, the connection of the works with the reservoirs, and the duplication of the reservoir at Villejuif. The works at St. Maur, on the Marne, will be strengthened by ten new engines, representing 1650-horse power; while the number of filter-beds will be nearly quadrupled (from 6 to 23), which will allow of the filtration of 88,320 cubic metres of water per day. The works at Charonne, which receive the Seine water and send it to the reservoirs at Ménilmontant, will be augmented to the extent of 200-horse power; and those on the Quai d'Austerlitz will be equipped with five additional engines, equal to 1450-horse power, which will be put up in buildings to be erected on land in the neighbourhood belonging to the City. With regard to the trunk mains which will be necessary to connect the works with the corresponding reservoirs, they will be 3 ft. and 3 ft. 3 in. in diameter, and will represent a total length of 10 miles of pipes to be placed in subways. The size of the reservoir at Villejuif will be doubled by the addition of two new compartments, which will raise its capacity from 25,000 to 50,000 cubic metres. The cost of these extensions is estimated at 11,450,000 frs. (£458,000); being 7,400,000 frs. for the works, 3,300,000 frs. for the mains, and 750,000 frs. for the additions at Villejuif.

## CONFERENCE ON WATER FILTRATION.

Under the auspices of the Royal Sanitary Institute, a conference on the subject of the filtration of water was held in the Town Hall, Hastings, on the 25th ult., under the presidency of Colonel J. Lane Potter, M.A., M.D., &c., the Chairman of the Council of the Institute.

The first paper was by Mr. S. Wilson, the Medical Officer of Health for Hastings. Having dwelt upon the necessity of the town meeting the exacting demands of a first-class health and pleasure resort, and shown how the authorities had endeavoured to do this, he remarked that there was no agency more potent for harm, or more fraught with possible disaster on a colossal scale, than was to be found in the use for drinking purposes of contaminated water. During his fifteen years' tenure of the office he held, he had never had occasion to suspect the water as a cause of illness. The town, indeed, enjoyed remarkable immunity from typhoid fever, and not a single case of the disease had originated in Hastings this year among a population of nearly 67,000. Mr. Wilson went on to deal with the two objects of filtration, and mentioned instances in which disasters had been avoided by careful dealing with water. He mentioned the recent case of Lincoln, and urged that no false sense of security, bred of over-reliance on the permanent efficacy of any system of filtration, should induce his audience to abandon any available means of protecting from pollution the sources of their water supplies, nor to let pass any opportunity of substituting for a tainted an unpolluted water service.

Mr. P. H. Palmer, the Borough Engineer of Hastings, dealt with the subject of "Pressure Filters." He said the results obtained with water from deep wells from the Hastings Water-Works, after passing through mechanical filters, had been eminently satisfactory; the water having been deprived of all the free and albuminoid ammonia, and as much as 96 per cent. of iron. The results of 18 bacteriological investigations showed that no less than 91¾ per cent. of the bacteria had been removed by filtration, even after 72 hours' incubation. The Corporation had installed two large batteries of the Candy filters—one at West Hill, St. Leonards, being capable of dealing with 40,000 gallons of water per hour, and those at Brede with 65,000 gallons per hour. The rate of filtering was very largely in excess of that generally allowed for open sand beds, and what would be allowable if the water was bacteriologically impure. The fact that Hastings had fewer cases of enteric fever in a year than any other of the 28 large towns of England was, he thought, largely due to the care taken, by means of efficient filtration, to give a pure supply of water to its inhabitants.

A short paper on "The Chemical Aspect of Filtration" was read by Mr. H. F. Cheshire, B.Sc., F.I.C., who technically described the process of filtration and its effect upon the water.

In the course of the discussion which followed, Dr. Rideal questioned whether pressure filters have any hygienic advantage in purification over the old-fashioned filtration. He said there were instances of these pressure filters breaking down, and therefore they did not ensure immunity from typhoid. There were methods which might be adopted in every house to secure a pure water supply by means of various filters. The health aspect of the question had to be treated in a different way from the two mentioned—by filtration. What they wanted for the use of the drinking population was water free from contamination—in the state in which they would find a glass of water that had become cool after being boiled. Pressure filters were more likely to be used in climates which were very variable; and in the matter of control, they had an advantage over sand filters. Mr. H. Stott remarked that the purification of water by means of mechanical filtration was not so good as Nature. In giving statistics of 207 towns and villages, he said that in 76 obtaining their water from deep wells the average death-rate was 13·2; 36 were supplied from rivers, some without filtration, and the death-rate was 17·4; 39 from springs, and the average death-rate was 16·3; and 56 from upland surface water, with an average death-rate of 16·9. Mr. W. Whitaker, F.R.S., dealt with the question more from the geological aspect. He said that where a place could get a supply of water that did not want anything to be done to it, it ought to get it. Referring to the use of Thames water in London, he said that the Thames was an exceptional river, composed of spring water generally; and no other river could supply London like it. The Chairman, in closing the discussion, advocated the introduction of a Bill by the Government to divide the country into water areas. He thought that the smaller rivers were the safest sources of supply.

## NOTES FROM SCOTLAND.

**From Our Own Correspondent.**

*Saturday.*

At the monthly meeting of the Edinburgh and Leith Gas Commissioners on Monday—Provost Mackie, of Leith, in the chair—the Engineer's report for the month of October showed that the quantity of gas made was 191,288,000 cubic feet, which was an increase of 2,875,000 cubic feet over October of last year; and that since May 15 the quantity has been 642,338,000 cubic feet, which is an increase over the corresponding period of 7,433,000 cubic feet. The average price of coal was 12s. 3·8d. per ton, as against 11s. 10·1d. last year.

It was agreed that, as before, the whole of the members of the Commission should be members of both of the Standing Committees—the Works and the Finance and Law. Judge Bryson, of Leith, was, with a well-deserved compliment upon his fidelity to the duties, re-appointed Convener of the Works Committee; and Bailie Menzies, of Edinburgh, was re-appointed Convener of the Finance and Law Committee.

The Commissioners sat in private to consider a letter from the Corporation of Leith regarding the alleged smells from the Granton Gas-Works. The letter was not divulged; but it will come up again.

The annual statement of gas manufacture with costs, displaying the various items for every year since the Commissioners came into existence in 1888, was laid before the meeting. The totals for the last financial year were given fully in the "JOURNAL" when the annual accounts were issued; so that they need not be repeated. But the statement brings out results, by comparison, which are not without interest. For instance, it is shown that there has been an unbroken series of increases in the quantities of gas made every year since 1894, and that the aggregate of the increases amounts to 45 per cent. The gas made per ton of coal has been over 10,000 cubic feet every year since 1892; but until last year, when the quantity was 10,798 cubic feet, as against 10,361 cubic feet in the preceding year, the Commissioners were never able to sell so much as 10,000 cubic feet per ton. The sales last year were 10,051 cubic feet, compared with

## GAS COMPANIES' STOCK AND SHARE LIST.

**Referred to on p. 674.**

| Issue. | Share. | When last Dividend. | Dividend or Dividend & Bonus. | NAME. | Closing Prices. | Rise or Fall in Wk. | Yield upon Investment. |
|---|---|---|---|---|---|---|---|
| £ | | | p.c. | | | | £ s. d. |
| 590,000 | 10 | Oct. 13 | 10½ | Alliance & Dublin 10 p.c. | 20⅛—21⅛ | −⅛ | 4 17 8 |
| 160,000 | 10 | ,, | 7½ | Do. 7 p.c. | 14½—15½ | .. | 4 16 9 |
| 200,000 | 5 | Nov. 15 | 7 | Bombay, Ltd.. . . . | 6¾—7¼ | .. | 4 16 7 |
| 40,000 | 5 | ,, | 7 | Do. New, £4 paid | 5—5⅛ | .. | 5 1 10 |
| 50,000 | 10 | Aug. 31 | 14 | Bourne- 10 p.c. . . | 29—30 | .. | 4 13 4 |
| 51,810 | 10 | ,, | 7 | mouth Gas B 7 p.c. . | 17—18 | .. | 3 17 9 |
| 53,200 | 10 | ,, | 6 | and Water Pref. 6 p.c. | 15⅛—16⅛ | .. | 3 12 9 |
| 380,000 | Stk. | Aug. 16 | 12½ | Brentford Consolidated | 258—263 | .. | 4 15 1 |
| 300,000 | ,, | ,, | 9⅜ | Do. New . . . | 197—202 | .. | 4 14 1 |
| 50,000 | ,, | ,, | 5 | Do. 5 p.c. Pref. . | 125—130 | .. | 3 16 11 |
| 206,250 | ,, | June 15 | 4 | Do. 4 p.c. Deb. . | 103—106 | .. | 3 15 6 |
| 220,000 | Stk. | Sept 15 | 11¼ | Brighton & Hove Orig. | 220—225 | .. | 5 0 0 |
| 246,320 | ,, | ,, | 8¼ | Do. A. Ord. Stk. . | 160—165 | .. | 5 0 0 |
| 460,000 | 20 | Sept. 28 | 10 | British . . . . . | 42½—43½ | .. | 4 11 11 |
| 100,000 | Stk. | Aug. 16 | 6 | Bromley, Ord. 5 p.c. . | 120—123 | .. | 4 17 7 |
| 165,700 | ,, | ,, | 4½ | Do. do. 3½ p.c. . | 90—93 | .. | 4 16 9 |
| 500,000 | 10 | Oct. 13 | 7 | Buenos Ayres (New) Ltd. | 12¼—12¾ | −¼ | 5 9 10 |
| 250,000 | Stk. | June 29 | 4 | Do. 4 p.c. Deb. . | 96—98 | .. | 4 1 8 |
| 150,000 | 20 | July 13 | 8¼ | Cagliari, Ltd. . . . . | 24—26 | .. | 6 6 11 |
| 100,000 | 10 | Sept. 28 | 10 | Cape Town & Dis., Ltd. | 17—17½ | .. | 5 14 3 |
| 100,000 | 10 | Oct. 27 | 4½ | Do. 4½ p.c Pref.. . | 10—10½ | .. | 4 5 9 |
| 50,000 | 50 | Nov. 2 | 6 | Do. 6 p.c. 1st Mort. | 52—54 | .. | 5 11 1 |
| 50,000 | Stk. | June 29 | 4½ | Do. 4½ p.c. Deb. Stk | 102—104 | .. | 4 6 7 |
| 1,434,680 | Stk. | Aug. 31 | 5⅛ | Commercial 4 p.c Stk. . | 116—118 | .. | 4 8 1 |
| 560,000 | ,, | ,, | 5 | Do. 3½ p.c. do. . | 112—114 | −1 | 4 7 9 |
| 450,000 | ,, | June 15 | 3 | Do. 3 p.c. Deb. Stk. | 86—88 | .. | 3 8 2 |
| 800,000 | Stk. | ,, | 6⅛ | Continental Union, Ltd. | 128—131 | .. | 4 19 3 |
| 200,000 | ,, | ,, | 7 | Do. 7 p c Pref. | 145—150 | .. | 4 13 4 |
| 424,070 | Stk. | — | 5½ | Derby Con. Stk. . . . | — | .. | — |
| 55,000 | ,, | June 3 | 4 | Do. Deb. Stk. . . . | — | .. | — |
| 486,090 | 10 | July 28 | 11 | European, Ltd. . . . | 22—23 | .. | 4 15 8 |
| 354,000 | 10 | ,, | 11 | Do. £7 10s. paid | 15—16 | .. | 5 3 2 |
| 15,223,235 | Stk. | Aug. 16 | 4⅛ | Gas- 4 p.c. Ord. . . | 101—102 | .. | 4 6 3 |
| 2,600,000 | ,, | ,, | 3½ | light 3½ p.c. max. . . | 90—92 | .. | 3 16 1 |
| 3,799,735 | ,, | ,, | 4 | and 4 p.c. Con. Pref. | 110—113 | .. | 3 10 10 |
| 4,193,975 | ,, | June 15 | 3 | Coke 3 p.c Con. Deb. | 87—89 | +1 | 3 7 5 |
| 258,740 | Stk. | Sept. 15 | 5 | Hastings & St. L. 3½ p.c. | 98—101 | .. | 4 19 0 |
| 70,000 | 10 | Oct. 13 | 11 | Hongkong & China, Ltd. | 19½—20½ | .. | 5 7 4 |
| 3,800,000 | Stk. | Nov. 15 | 10 | Imperial Continental . | 233—236 | .. | 4 4 9 |
| 473,600 | Stk. | Aug. 16 | 3½ | Do. 3½ p.c. Deb. Red. | 96—98 | .. | 3 11 5 |
| 175,242 | Stk. | Aug. 31 | 6 | Lea Bridge Ord. 5 p.c. . | 123—128 | .. | 4 13 9 |
| 561,000 | Stk. | Aug. 16 | 10 | Liverpool United A . . | 234—236 | .. | 4 4 9 |
| 718,100 | ,, | ,, | 7 | Do. do. B . . | 172—174 | .. | 4 0 6 |

| Issue. | Share. | When last Dividend. | Dividend or Dividend & Bonus. | NAME. | Closing Prices. | Rise or Fall in Wk. | Yield upon Investment. |
|---|---|---|---|---|---|---|---|
| £ | | | p.c. | | | | £ s. d. |
| 306,083 | Stk. | June 29 | 4 | L'rpool Unit'd Deb. Stk. | 111—113 | .. | 3 10 10 |
| 75,000 | 5 | ,, | 5 | Malta & Medn., Ltd. . | 4½—5 | .. | 5 0 0 |
| 560,000 | 100 | Oct. 2 | 5 | Met. of 5 p.c. Deb.. | 100—102 | .. | 4 18 0 |
| 250,000 | 100 | ,, | 4½ | Melbourne 4½ p.c. Deb. | 100—102 | .. | 4 8 3 |
| 541,920 | 20 | Nov. 15 | 3½ | Monte Video, Ltd. . . | 11½—12½ | .. | 5 12 0 |
| 1,565,892 | Stk. | July 29 | 4½ | Newc'tle & G'tesh'd Con. | 107—108 | .. | 4 5 8 |
| 406,025 | Stk. | June 29 | 3½ | Do. 3½ p.c. Deb. | 99—101 | .. | 3 9 4 |
| 15,000 | 10 | Aug. 31 | 10 | North Middlesex 10 p.c. | 18½—19½ | .. | 5 2 7 |
| 52,940 | 10 | ,, | 7 | Do. 7 p.c. | 13—14 | .. | 5 0 0 |
| 300,000 | Stk. | Nov. 30 | 8 | Oriental, Ltd. . . . | 147—150* | .. | 5 6 8 |
| 600,000 | 5 | Sept. 14 | 7 | Ottoman, Ltd. . . . | 6—6½ | .. | 5 7 8 |
| 168,255 | Stk. | — | 6½ | Plym'th & St'house 5 p.c. | — | .. | — |
| 398,490 | 5 | Apl. 28 | 6 | Primitiva Ord. . . . | 7—7½ | +⅛ | 4 0 0 |
| 796,980 | 5 | July 28 | 5 | Do. 5 p.c. Pref. . | 5⅛—5⅝ | .. | 4 13 0 |
| 488,900 | 100 | Dec. 1 | 4 | Do. 4 p.c. Deb. . | 96—98* | .. | 4 1 8 |
| 851,070 | 10 | Oct. 13 | 7 | River Plate Ord. . . . | 12⅜—13⅛ | .. | 5 5 8 |
| 300,000 | Stk. | June 29 | 4 | Do. 4 p.c. Deb. . | 96—98 | .. | 4 1 8 |
| 250,000 | 10 | Sept. 28 | 7 | San Paulo, Ltd. . . . | 13—13⅛ | .. | 5 3 8 |
| 70,000 | 50 | July 1 | 5 | Do. 5 p.c. Deb. . | 51—53 | .. | 4 14 4 |
| 135,000 | Stk. | Sept. 14 | 10 | Sheffield A . . . . | 244—246 | .. | 4 1 4 |
| 209,984 | ,, | ,, | 10 | Do. B . . . . | 244—246 | .. | 4 1 4 |
| 523,498 | ,, | ,, | 10 | Do. C . . . . | 244—246 | .. | 4 1 4 |
| 126,106 | Stk. | Aug. 31 | 5⅛ | Shrewsbury Ord. 5 p.c. | 110—120 | +10 | 4 11 8 |
| 70,000 | 10 | Sept. 28 | 10 | South African . . . . | 15⅜—16⅜ | .. | 6 1 3 |
| 6,250,000 | Stk. | Aug. 16 | 5⅛ | South Met., 4 p.c. Ord. | 132—134 | .. | 4 2 1 |
| 1,895,445 | ,, | July 13 | 3 | Do. 3 p.c. Deb. | 87—89 | .. | 3 7 5 |
| 575,000 | Stk. | Aug. 16 | 5½ | S'th Suburb'n Ord. 5 p.c. | 123—126 | .. | 4 7 4 |
| 60,000 | ,, | ,, | 5 | Do. 5 p.c. Pref. . . | 125—130 | .. | 3 16 11 |
| 112,533 | ,, | July 13 | 5 | Do. 5 p.c. Deb. Stk. | 132—137 | .. | 3 13 0 |
| 502,310 | Stk. | Nov. 15 | 5 | Southampton Ord. . . | 109—112 | .. | 4 9 3 |
| 87,950 | ,, | — | 4 | Do. 4 p.c. Deb. | — | .. | — |
| 120,000 | Stk. | Aug. 31 | 6¾ | Tottenham A 5 p.c. . | 125—128 | +3 | 4 17 8 |
| 563,020 | ,, | ,, | 4¼ | and B 3½ p.c. . | 99—102 | +3 | 4 13 2 |
| 125,000 | ,, | June 29 | 4 | Edmonton 4 p.c. Deb. | 105—108 | .. | 3 14 1 |
| 182,380 | 10 | June 15 | 8 | Tuscan, Ltd. . . . . | 9⅝—10⅜ | .. | 7 16 1 |
| 149,900 | 10 | July 1 | 5 | Do. 5 p.c. Deb. Red. | 100—102 | .. | 4 18 0 |
| 30,000 | Stk. | Aug. 16 | 7¾ | Wands- A 5 p.c. . . | — | .. | — |
| 255,636 | ,, | ,, | 6¾ | worth B 3½ p.c. . . | 137—140 | .. | 4 9 3 |
| 60,000 | ,, | ,, | 5 17/20 | and C 3½ p.c. . . | 113—116 | .. | 4 13 6 |
| 57,564 | ,, | June 29 | 3 | Putney 3 p.c. Deb. Stk. | 82—85 | .. | 3 10 7 |
| 745,872 | ,, | Aug. 16 | 5 | West Ham 5 p.c. Ord. . | 106—108 | .. | 4 12 7 |
| 185,000 | ,, | ,, | 5 | Do. 5 p.c. Pref. . . | 123—126 | .. | 3 19 4 |
| 193,300 | ,, | June 29 | 4 | Do. 4 p.c. Deb. Stk. | 104—109 | .. | 3 13 5 |

Prices marked * are "Ex. div."

9668 cubic feet. The average cost of coal was 12s. 4·2d. per ton, as compared with 12s. 10·6d.; but deducting returns from residuals, the net cost was reduced to 6s. 5d. per ton, as compared with 6s. 10·9d. The net cost of coal per 1000 cubic feet of gas made was 7·13d., as compard with 8·01d. Manufacturing wages and charges, including purification, were at the rate of 3·20d. per 1000 cubic feet of gas made, as compared with 4·91d.; but it is to be observed that until two years ago these charges were seldom below 7d. per 1000 cubic feet. The total cost of coal, manufacture, and distribution was equal to 15·17d. per 1000 cubic feet of gas made, as compared with 17·02d.; but it is to be again observed that, prior to this, these charges amounted to as much as from 20d. to 25d. per 1000 cubic feet of gas made. The value of these figures lies in this, that they bring into prominence the great advantage which has been derived by the Commissioners from the erection of the new gas-works at Granton. Such results could never have been obtained in the old works.

At the end of April last, a man was run over by a locomotive belonging to the Corporation of Dundee, in their gas-works in East Dock Street, and was killed. The man's presence was unknown until the accident happened; and it was concluded that he had gone there for shelter, or had lost his way. The body was identified as that of Jas. Lamb. His widow and children have raised an action in the Dundee Sheriff Court against the Dundee Gas Commissioners, in which they sue for £800 as damages. The Commissioners, besides other pleas, maintain that the action is irrelevant, in respect that the accident took place within their private premises, to which Lamb had no right of access. This plea has been repelled; and the Sheriff has ordered proof in the case.

The Town Council of Grangemouth held their second special meeting on Monday for the purpose of considering the adoption of the Burghs Gas Supply Act. There was such unanimity among the Councillors present, that the resolution of the previous meeting, to adopt the Acts, on being read by the Town Clerk, was adopted without the formality of moving and seconding.

The Gas and Electricity Committee of the Aberdeen Town Council on Thursday adopted a report from the Manager of the gas-works—Mr. S. Milne—proposing various extensions of mains in the city.

The extensions at the works of the Larkhall Gas Company, to which I referred in the beginning of May last, have now been completed; the fine weather of the past summer having enabled the work to proceed with greater expedition than might have been. The extensions consist of a new retort-house, with new retort-bench, containing four ovens with six retorts in each, and room for other two ovens. The retorts, set back to back, are fired on the regenerative system. The coal-yard has been roofed over. In their former state, the works were capable of producing 24 million cubic feet of gas per year; they are now of a capacity of 60 million cubic feet. The extensions have been carried out on the advice of Messrs. A. Gillespie and Son, of Glasgow. Among the Contractors were—for the retort-bench, Messrs. J. Brown and Co., of Hamilton; and for the roof and inside iron work, Messrs. Henry Balfour and Co., of Leven, Fife.

## CURRENT SALES OF GAS PRODUCTS.

**Week ending Dec. 2.**

Tar products in the London market show little change. Pitch is in good demand, and all contracted for is being removed as rapidly as it can be delivered. There is also a good prompt inquiry, with the price at from 35s. 6d. to 36s. per ton net. Ninety per cent. benzol is about the same at 10½d. per gallon; and 60 per cent. crude carbolic is very firm at from 1s. 9½d. to 1s. 10d. net. 90-160° solvent has been sold at 1s., and 95-160° has again been done at 1s. 3d. net. Sulphate of ammonia has been in fair request, and £12 16s. 3d. is being bid, and £12 17s. 6d. being asked, on Beckton terms, for Spring delivery; while a slightly lower figure would be accepted for December.

LIVERPOOL, *Dec.* 2.

**Sulphate of Ammonia.**

Supplies have been more abundant, and, although there has been a fair amount of buying, prices have been barely maintained; direct buyers being already fairly well covered up to the end of the year, and being mainly interested in purchasing for later delivery. The closing quotations are £12 11s. 3d. to £12 12s. 6d. per ton f.o.b. Leith, £12 8s. 9d. per ton f.o.b. Liverpool, and £12 6s. 3d. per ton f.o.b. Hull. There has been good inquiry for delivery over the first four months of 1906; and a considerable business has been done abroad at the equivalent of about £12 12s. 6d. per ton f.o.b. U.K. ports. Makers for the most part stand out for higher prices, but there has been some first-hand selling at the above equivalent.

**Nitrate of Soda.**

This article remains a very quiet market; closing prices being 10s. 9d. to 11s. per cwt., according to quality.

LONDON, *Dec.* 2.

**Tar Products.**

Markets have been generally quiet during the past week, and, as a rule, prices have been slightly easier, with the exception of carbolic acid, which has been very firm. There has been a good demand from Germany for both prompt and forward delivery, and 1s. 9½d. is reported to have been paid in several instances. As regards January-June, there is a fairly good inquiry; but makers still ask 1s. 10d., which price consumers decline to pay. In crystals, there does not appear to be much business doing; and English manufacturers certainly show more anxiety to sell for both early and forward delivery. Ninety per cent. benzol has again been sold at 10d. for January-March by London distillers; but in the North this price is not obtainable for prompt delivery, and there is certainly more desire to sell forward than was the case a little while ago. For 50-90 per cent., makers still ask 10½d.; but at the present time consumers only offer 10d. to 10¼d. for this quality. Some has

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FOR ENRICHING GAS IN BULK.
PREVENTS NAPHTHALENE DEPOSITS.
OVER 120 MAXIM PATENT CARBURETTORS HAVE NOW BEEN FIXED.
Among the Companies and Towns supplied are The Gaslight and Coke Company, Manchester, Exeter, Birmingham, Leeds, Rochdale, Bristol, Sheffield, Oldham, Dundee, Perth, Dunfermline, and many other Works, both large and small, where they have been working in some instances for the past Ten Years.
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The Carburettor is inexpensive, easily fixed, and entirely supersedes the use of Cannel.
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recently been exported rather largely to France, doubtless with a view to extracting the toluol, which is at present very scarce, and makers are not willing to accept less than 11½d. per gallon for prompt delivery. There have been some inquiries on the market for this article for January-June; but makers at present ask rather more than consumers are willing to pay. Solvent naphtha continues still very firm; and business is reported all over next year in 95 per cent. at 160° at very good prices. Creosote is scarcely so firm, and there are actually sellers in London at under 2d. for early delivery. In Yorkshire, there is no fresh business to report. Sellers will not entertain anything under 1½d. per gallon forward, and in fact some makers ask more than this. Lancashire manufacturers are certainly not so anxious to sell as was the case a little while ago, and it is rather difficult to ascertain the exact value in this quarter. Large quantities of creosote salts have recently been shipped to America, which may have the effect of decreasing the demand for salty creosote later on. Pitch is quiet, and there is no business of importance to report. The principal London makers are now sellers at 35s.; but no business is possible at this price. As regards Yorkshire, there are now sellers at 34s. 6d.; but consumers do not appear open to pay more than 34s., although it is reported that business was done at a little over this for one of the best makes. Makers are fairly firm, both in Liverpool and Manchester, and there is not much offering, although manufacturers are evidently open to consider business for January-June. The demand in South Wales appears to have fallen off, especially as regards early delivery, but there are still buyers for January-June; while one or two of the largest consumers are open to contract all over next year, but only at prices under those ruling for early delivery.

The average values during the week were: Tar, 18s. 6d. to 22s. 6d.; Pitch, London, 34s. 9d. to 35s.; east coast, 34s. to 34s. 6d.; west coast, 32s. 6d. to 33s. Benzol, 90 per cent., 10d.; 50-90 per cent. 10d. to 10¼d. Toluol, 11d. to 11½d. Crude naphtha, 3⅜d. to 4d.; solvent naphtha, 10½d. to 11½d.; heavy naphtha, 11d. to 11½d. Creosote, London, 1⅞d. to 2d.; North, 1⅜d. to 1½d. Heavy oils, 2¼d to 2⅜d. Carbolic acid, 60 per cent., 1s. 9½d. to 1s. 9⅝d. Refined naphthalene, £4 10s. to £8; salts, 16s. 6d. to 18s. 6d. Anthracene, "A" quality, 1½d. to 1⅝d.; "B" quality, unsaleable.

**Sulphate of Ammonia.**

The market has been quiet during the week, but closes with rather a firmer tone. Beckton are not sellers for prompt, but quote £12 17s. 6d. for January-April. The South Metropolitan Company are still sellers at £12 16s. 3d.; but for December only, and are not offering for next year at present. In Hull, the market is decidedly firmer, and sales have been made at £12 10s. for prompt, while this price has been declined for forward delivery. There is no business of importance to report in Liverpool, but small sales are advised as having been made at £12 10s. to £12 11s. 3d. In Leith, the position remains unchanged. Manufacturers still quote £12 15s., but sales are reported by dealers at slightly under this figure.

## COAL TRADE REPORTS.

**Lancashire Coal Trade.**

The demand for coal is now good in all departments. Prices are firm, with a slight advance on new contracts for engine fuel and cannel. The pits are working full time. Stocks, however, have scarcely been touched at present. So far as can be foreseen, there is no likelihood of any change in the relations between miners and their employers in the matter of wages in January next, when the existing arrangement comes to an end. A steady trade is doing with shipping coal. Quotations at the pit mouth are: Best house coal 13s. 6d. to 14s. 6d., secondary 12s. to 13s., common 9s. to 10s., steam and forge 8s. to 9s., best engine fuel 7s. 6d. to 8s. 6d., best slack 6s. 6d. to 7s. 6d., medium 6s. to 7s., washed slack 7s. to 7s. 6d., common 5s. to 6s. Coal for shipping is 9s. 6d. to 10s. 6d.

**Northern Coal Trade.**

There has been a better demand for coal of both the chief classes; but as far as steam coals are concerned, the collieries do not find very full employment, though in part this is due to the non-arrival of steamers delayed by storms. Best Northumbrian steams are about 8s. 9d. per ton f.o.b.; for second-class steams the quotation is 8s. 3d.; and small steams are firm and rather scarce at from 5s. to 5s. 9d. In the Durham coal trade, the keen demand for gas qualities makes prices generally firmer. Good Durham gas coals vary from about 8s. 6d. to 9s. 3d. per ton f.o.b.; but so much of the output is taken up by the large contracts, which claim their full output at the present time, that there is not much coal free for sale, so that the best kinds are kept very strong in the prices. There are no heavy contracts for gas coals reported in the last few days; but there have been sales of moderate lots for shipment to some of the Italian and southern ports, at prices not much below those current in the market. Coke is generally very firm; but gas coke is adversely influenced by the very heavy production at present, and the stocks in some cases are heavy. Under these circumstances, sales of gas coke are more a matter of bargaining than of any fixed market price.

**Scotch Coal Trade.**

There is no change in the market. A good demand continues for all classes. Splint, in particular, is in strong request, and at the end of the week was advanced by 6d. per ton. Ell is also in demand. Steam coal has improved in demand—the first time this has been reported for many weeks. The prices quoted are: Main, 7s. 6d. to 7s. 9d. per ton f.o.b. Glasgow, ell 8s. 6d. to 9s. 3d., and splint 10s. to 10s. 3d. The shipments for the week amounted to 236,938 tons—a decrease of 18,629 tons upon the previous week (due to stormy weather), but an increase of 22,397 tons upon the corresponding week of last year. For the year to date, the total shipments have been 11,221,897 tons—an increase of 625,082 tons upon 1904.


# CARBURETTED WATER-GAS APPARATUS

**Merrifield—Westcott—Pearson Patents.**

## The Economical Gas Apparatus Construction Co., Ld.

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J. T. WESTCOTT, Manager.
L. L. MERRIFIELD, M.Inst.M.E., Engineer.

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CARBURETTED WATER-GAS ENGINEERS.

The above Company have erected since 1893, or are now erecting, their Universal Type of Carburetted Water-Gas Plant at the following Gas-Works:—

| | Cub. Ft. Daily. | | Cub. Ft. Daily. | | Cub. Ft. Daily |
|---|---|---|---|---|---|
| BLACKBURN | 1,250,000 | ST. CATHERINES (Remodelled) | 250,000 | TONBRIDGE | 300,000 |
| WINDSOR ST. WORKS, BIRMINGHAM | 2,000,000 | KINGSTON, PA. | 125,000 | STRETFORD | 500,000 |
| SALTLEY WORKS, BIRMINGHAM | 2,000,000 | PETERBOROUGH, ONT. | 250,000 | OLDBURY | 300,000 |
| COLCHESTER | 300,000 | WILKESBARRE, PA. | 750,000 | TODMORDEN | 500,000 |
| BIRKENHEAD | 2,250,000 | ST. CATHERINES (2nd Cont.) | 250,000 | SALTLEY, BIRMINGHAM (Third Contract) | 2,000,000 |
| SWINDON (New Swindon Gas Co.) | 120,000 | BUFFALO, N.Y. | 2,000,000 | YORK (Second Contract) | 750,000 |
| SALTLEY, BIRMINGHAM (Second Contract) | 2,000,000 | WINNIPEG, MAN. | 500,000 | ROCHESTER (Second Contract) | 500,000 |
| WINDSOR ST., BIRMINGHAM (Second Contract) | 2,000,000 | COLCHESTER (Second Contract) | 300,000 | NEWPORT (MON.) | 250,000 |
| HALIFAX | 1,000,000 | YORK | 750,000 | TOKIO, JAPAN | 1,000,000 |
| TORONTO | 250,000 | ROCHESTER | 500,000 | PERNAMBUCO (Brazil) | 125,000 |
| OTTAWA | 250,000 | KINGSTON, ONT. | 300,000 | MALTON | 150,000 |
| LINDSAY (Remodelled) | 125,000 | CRYSTAL PALACE DISTRICT | 2,000,000 | DULUTH, MINN. (2nd Cont.) | 300,000 |
| MONTREAL | 500,000 | DULUTH, MINN. | 300,000 | BROCKVILLE (ONT.) | 250,000 |
| TORONTO (Second Contract Remodelled) | 2,000,000 | CATERHAM | 150,000 | SMETHWICK | 500,000 |
| BELLEVILLE | 250,000 | LEICESTER | 2,000,000 | GRAVESEND | 300,000 |
| OTTAWA (Second Contract) | 250,000 | ENSCHEDE (HOLLAND) | 150,000 | NEWPORT MON. (Second Contract) | 250,000 |
| BRANTFORD (Remodelled) | 200,000 | BUENOS AYRES (RIVER PLATE CO.) | 700,000 | TORONTO (Third Contract) | 750,000 |
| | | BURNLEY | 1,500,000 | TORONTO (Fourth Contract) | 1,000,000 |
| | | KINGSTON-ON-THAMES | 1,750,000 | MONTREAL, ONT. (2nd Cont. | 1,800,000 |
| | | ACCRINGTON | 500,000 | HAMILTON, ONT. | 400,000 |

**LEEDS, 1,800,000 C. Ft. LEICESTER (2nd Cont.), 1,000,000 C. Ft. NEWCASTLE-ON-TYNE, 1,800,000 C. Ft.**

**AND, IN ADDITION, 8,150,000 CUBIC FEET DAILY; also Coal-Gas Plants at NELSON, B.C., CHATHAM, BERLIN, NAPANEE, OWEN SOUND, CALGARY, and WINNIPEG.**

## London Show-Rooms for Messrs. Geo. Bray and Co., Ltd.

All roads lead to London; and most gas engineers and managers in the course of a year visit the Metropolis more than once. The same cannot be said of even great industrial cities like Leeds, Manchester, Birmingham, and so on; and therefore it is almost imperative that our big firms should have a central place in London, whereat to exhibit such of their goods as size will permit of their doing. For some time Messrs. Geo. Bray and Co., Limited, have had an office in London; but they have now opened show-rooms at 17, Farringdon Street (adjoining the Memorial Hall). These are in charge of their London representative, Mr. J. R. Phelp. A visit is interesting, as it shows how considerably the firm have entered into the incandescent business, and in doing so how studiously they have developed their productions. But (we do not know whether we are giving away a secret, anyway it is an item of interest for the gas industry), owing to the extraordinary growth of the prepayment meter system of supply, the firm, we learn, are turning out more flat-flame burners than ever. Some instructive information can be obtained in this connection at the show-rooms on the uneconomical practice of using flat-flame burners that are not suited to the quality and composition of the gas; and one gets an insight at the same time into the enormous consumption of gas by the indiscriminate use of old flat-flame burners. In consequence of this, the firm are now specially making burners to suit the particular gas of individual companies. A profitable half hour can be spent in looking into a pamphlet, issued by Messrs. Bray and Co., giving the results of tests on this question of consumption and illuminating powers of flat-flame burners. All types of the newest forms of the firm's flat-flame burners are to be seen at the show-rooms, including the economizer and adjustable patterns. Acetylene burners in common and curious styles are also on view. Then we come to the most attractive features—the incandescent burners and fittings. The firm's ordinary incandescent burner, with its gas and air adjusters, and beautifully constructed head, has won much favour, as have also their reversible inverted burners for either ordinary or inverted fittings. Some very striking combinations can be made with this burner. A cheap, simple, and neat form of self-insensifying lamp is worth inspection. Of fittings, globes, and shades, there are samples of choice design; and, in fact, a careful examination of them will bear out the firm's claim that cheapness, good material, and high efficiency are companionable merits. The firm's mantles, of course, are used on all the fittings. Street-lanterns are also shown—a feature just now being those fitted with an anti-vibrating arrangement; the incandescent burner being suspended from the top of the lamp by a swinging frame, with the gas supply to the burner connected from the service-pipe by a flexible tube. This form of lamp-fitting has been adopted for railway arch lighting, than which a more severe test of efficiency could not be desired.

The Barnstaple Gas Company have been asked by the Electric Light Committee of the Town Council to quote a price for the supply of gas for lighting the public lamps on the incandescent system.

## Weston-super-Mare Gas-Purchase Scheme Negatived.

Last Wednesday, the Weston-super-Mare Urban District Council held a statutory meeting to decide whether a Bill should be promoted sanctioning the purchase of the gas-works. At a ratepayers' meeting held previously, the proposal had been negatived by a substantial majority. It was moved that the Council meeting should stand adjourned until the 7th inst., and that in the meantime a post-card *plébiscite* of the town be taken, with a view to ascertaining the wishes of the whole of the ratepayers. The Clerk, however, explained that the meeting had no power to decide upon a *plébiscite* (a resolution for which could only be passed at a specially-convened meeting); and therefore the latter portion of the proposition was abandoned. On being submitted, the proposition to adjourn was defeated by eight votes to six; and on a division being taken on the resolution that application should be made to Parliament for an Act sanctioning the purchase, it was defeated by a like majority. The proposal to acquire the gas undertaking thus falls to the ground.

## Extensions at the Coleraine Gas-Works.

Mr. A. D. Price, M.Inst.C.E., one of the Engineering Inspectors of the Local Government Board for Ireland, last Tuesday held an inquiry in the Town Hall, Coleraine, into an application made by the Urban District Council for a loan of £3000 for the improvement and extension of the gas-works. Dr. H. A. Anderson represented the Council; and the Rev. John Fawcett attended to object to the amount applied for. Dr. Anderson having given evidence to show the need for the proposed improvements, Mr. W. Henry, the Town Clerk, stated that the total outstanding indebtedness of the town was £14,323; and since the application for the present loan had been sent in, a half-year's instalment had been paid to the Board of Works. The available margin was £23,960. The Council proposed to ask that the loan for the improvements to the gas works should be made repayable in 20 years. The present rate of interest was 3½ per cent., and the first year's instalment with interest would be £255—diminishing as the principal was paid off. Mr. Fawcett contended that a greater profit should be made out of the gas-works; that such a large outlay as that proposed was not required; and that the contribution to public lighting should be increased as the number of public lamps was enlarged. Mr. Henry said the Gas Committee hoped to be able to pay off the loan out of the profits of the gas-works and still make a contribution to public lighting. Mr. John Taylor, the Manager of the works, having given evidence, in the course of which he described the nature of the improvements, Mr. W. J. Given, the Town Surveyor, said he estimated at £413 the cost of the structural alterations incidental to the introduction of the new plant. Mr. H. A. Gribbon, the former Chairman of the Council, and Mr. Joseph Irwin, the present Chairman, gave evidence in favour of the scheme; and Mr. Fawcett made a short statement in support of his contention. The inquiry then concluded.


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that WRIGHTS BUILD.

Where is the other,
from North or from South,
Whose praise is so constant in everyone's mouth
As the Gas Steam "ST. ANDREW"
that WRIGHTS BUILD ?

John Wright & Co.,
Essex Works,
Birmingham.

**Fire at the Loughborough Gas-Works.**—On the night of last Sunday week, there was an outbreak of fire at the Loughborough Gas-Works, caused by the blowing of a seal. Thanks to the promptitude of the Manager (Mr. E. Onions) and the brigade, however, the conflagration was extinguished before serious damage had been done.

**Unprofitable Electricity at Wednesbury.**—The Borough Auditor's annual report on the Wednesbury electricity undertaking states that the loss on actual trading for the past year was about equal to a rate of 1d. in the pound; but two-thirds was in respect of capital charges. It should, however, be noted that no deduction had been made for depreciation.

**Private Lamps on Footpaths in Oxford Street.**—In order to facilitate the progress of passenger traffic in Oxford Street, and relieve, in some measure, the congestion that exists at the more busy spots, the Marylebone Borough Council have ordered the removal of all private lamps now standing on the footpaths of the thoroughfare. The order has been regarded as a hardship upon certain tenants; but the Town Clerk of Marylebone states that in reality it is not so. The shopkeepers of Oxford Street are at liberty to illuminate their premises how and as much as they please, provided they do not obstruct the footpaths. Bracket lamps, such as are in general use, are not objected to; and the new regulation will, it appears, only affect a few traders.

**The Fatal Gas Explosion at Houghton-le-Spring.**—Unfortunately, the gas explosion at the Houghton-le-Spring almshouses, which was referred to in last week's "JOURNAL," has ended fatally in the case of one of the two inmates who were injured. At the subsequent inquest on the deceased—a woman named Dorothy Myers, 82 years of age—her daughter stated that, so far as she was aware, no blame for the occurrence attached to anyone. Alice Hamilton, another inmate of the almshouses, said that on the night of the explosion, at about 6.30, she was sitting in her room when she heard someone screaming. She ran into the room of Mrs. Wisby (one of the inmates), and saw her in flames. Having put the flames out, she returned to her own room. About 9 o'clock, she heard a loud noise; and on going out saw Mrs. Myers' house a heap of ruins. She did not notice any sign of an escape of gas in her house. The Coroner: Did Mrs. Wisby tell you what set her on fire? Witness: Yes. She said a blue light came to the top of the lamp, by which she was reading, and set fire to her hair. They did not suspect there was any escape of gas even after that. Mr. G. A. Charlton, the Manager of the Houghton-le-Spring Gas-Works, stated that he made an examination, and found that at the back of the houses there was an escape of gas, which was aflame. He cut the main, and stopped it. On the following day, he made an inspection of the main, and discovered that the explosion had been caused by a "slipped" joint; the pipe-joints being drawn about a quarter-of-an-inch. There were two cracks in the walls, which pointed to pit subsidence. In his opinion, the gas first began to escape when Mrs. Wisby's house was set on fire. The Jury returned a verdict of "Accidental death from unforeseen circumstances."

**Gas-Mains in Westminster.**—The Works Committee of the Westminster City Council reported last Tuesday that they had decided that when consenting to the laying of a new main across a street a condition will be imposed that not more than half of the width of the roadway shall be closed at one time, except with the express consent of the City Engineer, or for a longer period than shall be approved by him. The parties carrying out the work are to give notice to the police of this consent, and of the date and time when the roadway will be closed.

**Private Bills for Next Session.**—Thursday, the 30th ult., was the last day for lodging at the Private Bill Office of the House of Commons plans and sections of schemes to be promoted by means of Private Bills in the ensuing session. At the close of the day, 222 deposits had been made, of which 34 related to railways, 12 to tramways, 114 to Provisional Orders (including electric lighting applications), and 62 to miscellaneous measures. This total compares with 224 deposits last year, of which 27 referred to railways, 9 to tramways, 128 to Provisional Orders, and 60 to miscellaneous measures. There is an increase this year under all heads except Provisional Orders, in regard to which there is a diminution of 14.

**Cost of Broken Gas-Lamps at St. Helens.**—In connection with a case in which some boys were charged with wilfully damaging gas-lamps, Mr. S. Glover, the Engineer to the St. Helens Gas-Works, gave some interesting particulars regarding the cost to the Corporation of replacing broken glasses. He said that during the year they had had to repair 2485 squares of glass in the lamps, 224 oval tops to cylindrical lamps, and 253 cylindrical lamp glasses in the town. He did not think that the defendants and others like them realized the seriousness of it; but still they were doing damage to the public property. In answer to the Bench, Mr. Glover stated that it cost the Gas Committee £150 last year for the repair of gas-lamps in the borough.

**New Joint-Stock Companies.**—The Amman Valley Gaslight and Coke Company, Limited, has been registered with a capital of £25,000, in £1 shares, to adopt agreements with the Gas and Water Works Supplies and Construction Company, Limited, and between this Company and the Ammanford Urban District Council, to develop and turn to account the undertakings, properties, rights, and interests therein mentioned, and to carry on the business of a gas and water works company in all its branches. The minimum cash subscription is 100 shares. The Charing and District Gas Company, Limited, has been registered with a capital of £6000, in £5 shares, to acquire the business carried on as the Charing Gas Company, by Messrs. B. J. L. Thomson and F. L. Ball, at Charing, Kent; to adopt an agreement with the vendors; and to light with gas or other illuminant the parishes of Charing, Lenham, and Harrietsham, in Kent. There will be no initial public issue. The Imperial Automatic Light, Limited, has been registered with a capital of £10,000, in £1 shares, to adopt an agreement with the United Engineering Company, Limited, and to carry on the business of lamp manufacturers, producers and suppliers of acetylene or other gas, oil, and electric light, electricians, &c.


# INCLINED RETORTS.

# NEW WORK 1906.

Now is the time to get Particulars of our Patent Inclined Retort-Bench, which costs about **20 per cent. less** than the old design and is equally effective. We can arrange to work it in your existing House without raising the Roof.

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**16 YEARS' in Manufacture of Conveyors and Elevators for same.**

**33 CONTRACTS COMPLETED.**

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Measure Chamber,
Coke Carrier,
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Inclined Retorts,
AND
**W. T. HOLLAND'S**
Grit-Proof Bearings.

**No Gas-Works is complete unless the above are in use.**

# NEW CONVEYOR Co., LTD., SMETHWICK.

**Suggested Purchase of the Pontypool Water-Works.**—A conference has taken place between the Pontypool, Abersychan, and Panteg Urban District Councils with regard to a proposal to acquire the water undertaking of the Pontypool Gas and Water Company. Reports will in due course be presented to the Councils interested.

**Sale of Stock and Shares.**—Mr. A. Merry recently conducted a sale which included some stock and shares in the Dunstable Gas and Water Company. A parcel of £100 of 4 per cent. debenture stock realized £102; some £10 "A" shares sold for £16, £16 10s., and £17 each; and some £2 "B" shares for £1 12s. 6d. and £1 15s. apiece. Two £10 shares in the water undertaking, offered the same day, fetched £16 10s. each.

**The Illuminating Power Question at Leeds.**—We learn that the Gas Committee of the Leeds Corporation will ask the Council at their next meeting for authority to make experimental tests on the candle-power of the gas supplied to consumers, and will suggest that the resolution adopted by the Council in July, 1893, directing the minimum illuminating power shall not be below 18 candles, shall be varied accordingly.

**Lecture on Gas at Hertford.**—An interesting lecture was recently given at the Coatbridge Hall, Hertford, by Mr. F. N. Sumner, Assistant to Mr. H. D. Duesbury, Engineer and Secretary of the Hertford Gas Company, which showed conclusively the superiority of gas over electricity for lighting purposes. The lecture was followed by a discussion, in the course of which several persons residing in houses fitted up for electricity expressed themselves more favourably disposed towards gas. This is assuredly a step in the right direction.

**Repair of Roads after Pipe-Laying.**—Attention was called at the last meeting of the Sidmouth District Council to the bad state in which the roads were left after being opened by the gas and water companies and private individuals for the purpose of laying pipes and making drains. It was decided that before breaking up a road under the control of the Council for any purpose, all persons are to deposit 4s. per lineal yard of the section of road required to be opened; the sum deposited to be returned when the Surveyor certifies that the road has been restored to its former state.

**Dellwik Water-Gas Plant at the Prescot Gas-Works.**—In addition to the two-lift Gadd and Mason gasholder which, as mentioned in the "JOURNAL" last week, Messrs. R. & J. Dempster, Limited, have erected at the Prescot Gas-Works, the firm have supplied Dellwik water-gas plant of a capacity of 120,000 cubic feet per day. The gearing has been so arranged that the plant can be operated from the ground floor, thus preventing the necessity for any staging. We learn that the preliminary tests have shown that the plant is capable of producing upwards of 150,000 cubic feet of gas per 24 hours, and that 15 per cent. of water gas can easily be mixed with the coal gas without any reduction in candle power.

**Berwick Water Supply.**—There is at present under discussion a new water scheme for the supply of Berwick and Tweedmouth and the seaside resort of Spittal. The cost is estimated at £20,000. The Berwick Town Council, at their last meeting, decided that they would adjourn their final decision in the matter for a month, in order to permit of meetings of ratepayers to be held for taking the proposal into consideration.

**Public Lighting of Stanley.**—Much commotion has lately been caused in Stanley by a proposal of the Urban District Council to inaugurate a scheme of public lighting, which, however, provided for gas-lamps in only part of the area, and would involve an expenditure equal to about 4d. in the pound on the rates. The Council themselves were divided on the question; and the adoption of the proposal was carried only by the casting-vote of the Chairman. Since then the scheme has been condemned by public meetings, both on the ground of expense and because certain parts of the district were ignored by it. On a proposal in the Council to appoint a Committee to negotiate with the Wakefield Gas Company to carry out the scheme, the members were again divided, and the Chairman's casting-vote was once more needed in order to carry the resolution. There matters stand for the present.

**Sale of the Tarporley Gas-Works.**—The following paragraph with regard to the sale of the Tarporley Gas-Works is taken from the "Chester Chronicle:" "We are officially informed that the private negotiations for the disposal of the gas-works, which have been going on for some time, are nearly completed. Two Manchester gentlemen—Mr. William Kay and Mr. John Lowery—are the purchasers. Both gentlemen are members of the Manchester Gas Committee. It is surmised that they intend to build new works at Beeston. They would then be in a position to supply Bunbury on equal terms with Tarporley. The Tarporley Gas Company was formed in 1864, with a capital of £1200. Owing to the heavy cartage rates from Beeston, they have never been able to supply gas at less than 5s. per 1000 cubic feet; but, notwithstanding this, the shareholders have had no cause to complain, as for many years there has not been a dividend of less than 5 per cent. declared."

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A movement is in progress for federating the metal workers of the kingdom, with the view of improving their local organizations and concentrating their influence on legislation and in other directions. As a result of two conferences held in Birmingham, which were attended by delegates from a number of Trade Unions throughout the country, the Metal Trades Federation of Great Britain has been formed, and societies with a membership of more than 60,000 have already been affiliated. The regulation of wages on a more uniform basis is one of the objects in view; and the promoters state that the united resources of the constituent parts will always be at command to finance and maintain any necessary conflict with employers.


# ANOTHER DEVELOPMENT.

## A NEW ARTISTIC DESIGN.

THE

## "SHERATON"

is Fitted with the **"WILSON" New Gas-Fire** in which the **Fuel** is adapted to **Flame** as scientifically as Mantle to flame of Incandescent Light.

The Burner has a single supply, and both **Gas and Air are adjusted** at the front of Stove without removing the Burner and whilst the Gas is Burning.

With this scientific arrangement of fuel and adjustment of Gas and Air, **15 ft. of Gas** per hour in 10-inch Fire will **give as much heat** as 30 ft. in a good Fire, and 40 to 50 ft. in an average Gas-Fire on old unscientific construction.

**The "WILSON SHERATON."**

Size 20 in. wide by 27 in. high by 4½ in. deep, width of top 22½ in.

**PRICE,** with Boiling Burner and Sheet-Iron Back, **£2 2s. 6d.**

**WILSONS & MATHIESONS, LTD.,**

**CARLTON WORKS,**

**ARMLEY, LEEDS.**

**London Show-Rooms: 76, QUEEN ST., CHEAPSIDE, E.C.**

The Directors of the East London Water-Works Company (in liquidation) have declared a final distribution of assets at the rate of ¾ per cent.

The Pulsometer Engineering Company, Limited, have just received an order from the Worksop Urban District Council for one of their "Criton" water softeners, for 1500 gallons an hour, for their electricity station.

The Assessment Committee of the Windsor Union having recently ordered a professional revaluation of (*inter alia*) the South-West Suburban Water Company's works, mains, and pipes, as well as those of the Staines and Egham District Gas Company, the result being to considerably increase the assessments, the Directors retained the services of Messrs. C. F. Jones and Son, with the result that, without litigation and at small cost, reductions in the rateable values have been agreed of £682 in the case of the former Company and £400 in the latter.

Presiding at a meeting of Tubes Limited at Birmingham on Friday, Mr. Arthur Chamberlain stated, in moving the adoption of the report, that it showed a loss of £12,000, instead of a profit of £5000 which they had made the previous year. This was a disappointing result, because it had come in a year of general improvement in trade. He said this was explained by the fact that prices had fallen 25 per cent. last year, and during the past four years they had gone down altogether 55 per cent. He was convinced that, if prices did not go any lower, they would, by means of economies, avoid loss in the ensuing year. The report was adopted.

The "London Gazette" last Tuesday contained an announcement that, at the expiration of three months from that date, the Companies named in an appended list will be struck off the register, and the Companies dissolved, unless cause is shown to the contrary. The list includes the following: Campos City (Brazil) Water and Drainage Works Company, Continental Incandescent Gaslight Company, Denayrouze Light Syndicate, Elmsall and South Kirkby Gas Company, Hamor Lockwood and Co., Improved Gas and Oil Burners Company, Langhans Colonial Gas-Mantle Patents, Langhans Continental Gas-Mantle Patents, Langhans Oriental Gas-Mantle Patents, Loanda Gas Company, Patent Argand Gas and Oil Burners Company.

The Rhondda Urban District Council have placed an order with Messrs. Robert Dempster and Sons, Limited, of Elland, for a steel tank and gasholder 80 feet in diameter (prepared for three-lifts), complete with foundations, &c., to be erected at Treorchy. This town is in the centre of the upper portion of the district; and it is intended to draw gas, by means of an exhauster, off the trunk mains passing the proposed site of the holder during the daytime, fill the holder, and supply the district by means of it during the lighting hours. The Council have already a holder erected for a similar purpose by the same firm at Tony Pandy, where the arrangement here described has answered very satisfactorily. All the work has to be carried out under the supervision of Mr. Octavius Thomas, the Gas and Water Engineer to the District Council.

During a recent heavy storm at Sandgate, the electric light failed for some time, leaving a great portion of the place in darkness.

The Bournemouth Gas and Water Company, as will be seen by an announcement in our advertisement pages, are inviting tenders for an issue of 7 per cent. "B" shares.

The Newbury Town Council have authorized the taking of premises for the provision of offices and a show-room for the display of the latest types of lighting and heating appliances.

The Folkestone Gas Company are engaged in fitting up as a show-room for gas lighting, heating, and cooking appliances, large corner premises in the very centre of the business part of the town—quite close to the Town Hall.

The Lancaster Corporation have accepted the tender of Messrs. W. J. Jenkins and Co., Limited, for a coke-conveyor, with the necessary gas-engine, dynamo, and other fittings; the amount allowed for the whole contract not to exceed £3500.

As announced in the "JOURNAL" last week, the Robertsbridge, Salehurst, and Hurst Green Water and Gas Company, Limited, are inviting tenders for preference and ordinary £5 shares and £10 debentures, to be sent in not later than noon on the 12th inst.

The Penrith Rural District Council have adopted a scheme for supplying Hesket and the locality with water at an estimated cost of £7000. The source of supply is the Clint Springs, on Renwick Fell. The scheme has been prepared by Mr. Joseph Graham, of Carlisle.

A special meeting of the Crediton Urban District Council is to be held this week to consider the position with the Gas Company in connection with the proposed application for a Provisional Order to provide the town with electricity. It is stated that some members are of opinion that the Council have already consented to the Company's application.

We have received from the "Colliery Guardian" Company, Limited, the Colliery Manager's Pocket-Book and Diary for 1906. This is the 37th year of issue, and, under the editorship of Mr. R. A. S. Redmayne, M.Sc., &c., the Professor of Mining in the University of Birmingham, it maintains its well-established reputation. The diary portion of the book is followed by about 280 pages of closely-printed tabular and other matter, to which there is a useful index.

The officials in the Gas Department of the Manchester Corporation held their thirty-third annual soirée at the Holme Town Hall on Friday night. The Superintendent (Mr. Charles Nickson) presided, and was supported by Alderman Gibson, the Chairman of the Gas Committee, to whom the audience gave a most enthusiastic welcome. In the course of the evening, Mr. Nickson mentioned the interesting fact that this was the thirty-first time he had presided; and he reminded his hearers that the real object of these assemblies was the promotion of goodwill and *esprit de corps* in the department. Alderman Gibson also made a few pleasant remarks.


CARRON COMPANY'S

INCORPORATED BY ROYAL CHARTER 1773

Patent

Induction Condensing

GAS APPARATUS.

Radiates

HEALTHY HEAT

Second only

to that from

NATURE'S SUN.

EXPLANATORY BOOKLETS WITH YOUR NAME ON SUPPLIED FREE.

CARRON WORKS, Stirlingshire.

*AGENCIES AND SHOW-ROOMS:*—LONDON (City)—15, Upper Thames Street, E.C.; (West End)—23, Princes Street, Cavendish Square, W.; LIVERPOOL—30, Red Cross Street; GLASGOW—125, Buchanan Street; MANCHESTER—24, Brazennose Street; BRISTOL—10, Victoria Street; NEWCASTLE-ON-TYNE—18, Prudhoe Street; BIRMINGHAM—Stephenson Street; DUBLIN—44, Grafton Street; SOUTHAMPTON—Town Quay (The French Prison).

The Great Western Railway Company are lighting their stations on an extensive scale with incandescent burners. They have not adopted the bye-pass, but are lighting with torches; and they have entered into a contract with Messrs. Alexander Wright and Co. for the supply of Simmance-Abady patent torches for the purpose.

We have received from the Chemical Engineering Company and Wilton's Patent Furnace Company a pamphlet containing some well-executed illustrations, accompanied by particulars, of their furnaces, to the excellent working of which testimony is borne by a number of well-known gas engineers.

## WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

**Situations Vacant.**

GAS AND WATER MANAGER (WORKING). Ruabon Water Company and Rhos Gas Company. Applications by Dec. 13.
ASSISTANT MANAGER OR FOREMAN (SOUTH AMERICA). No. 4516.
MAINTENANCE. No. 4514.
SHOW-ROOM ATTENDANT. No. 4513.
CHARGE OF BOILERS, EXHAUSTERS, &c. Hoylake Gas Company.
MAINLAYER. No. 4508.
GAS-FITTER. No. 4509.

**Situations Wanted.**

ASSISTANT-ENGINEER OR MANAGER. No. 4507.
ASSISTANT-MANAGER OR WORKS FOREMAN. Tully, New Southgate.
CLERK. Price, Denbigh.
MANAGER (SMALL WORKS). Richards, Brewood.

**Plant (Second-hand) Wanted.**

GAS PLANT (6 millions capacity). Gas and Water Works Supplies and Construction Company.
RETORT MOUTHPIECES. No. 4511.
TANK WAGGONS. No. 4515.

**Plant (Second-hand) for Sale.**

LAMPS AND CAGES. Sutton-in-Ashfield Gas Department.

**Carbon Wanted.** No. 4512.

**Stocks and Shares.**

BOURNEMOUTH GAS AND WATER COMPANY. Dec. 14.

**TENDERS FOR**

**Condensers.**

RAMSGATE GAS DEPARTMENT. Tenders by Dec. 9.

**Elevating & Conveying Plant & Coal Breaker.**

NEWPORT (MON.) GAS COMPANY. Tenders by Jan. 3.

**Gas-Engine, &c.**

NEWPORT (MON.) GAS COMPANY. Tenders by Jan. 3.

**Gas-Works (Complete).**

GAS AND WATER SUPPLIES AND CONSTRUCTION COMPANY.

**Mainlaying and Excavation.**

ISLE OF THANET GASLIGHT COMPANY. Tenders by Dec. 14,

**Oil for Gas Making.**

ROCHDALE GAS DEPARTMENT. Tenders by Dec. 13.

**Purifiers, &c.**

NEWPORT (MON.) GAS COMPANY. Tenders by Jan. 3.

**Purifying Sheds.**

COVENTRY GAS DEPARTMENT. Tenders by Dec. 18.
NEWPORT (MON.) GAS COMPANY. Tenders by Jan. 3.

**Retort-Bench (Regenerative).**

NEWPORT (MON.) GAS COMPANY. Tenders by Jan. 3.

**Retort House Extension.**

NEWPORT (MON.) GAS COMPANY. Tenders by Jan. 3.

**Tank Waggons.** No. 4515.

**Tar and Liquor.**

BRIDGEWATER COLLIERIES. Tenders by Dec. 27.
HECKMONDWIKE GAS COMPANY. Tenders by Dec. 18.
MALVERN GAS DEPARTMENT. Tenders by Dec. 12.

**Washer (Livesey's).**

RAMSGATE GAS DEPARTMENT. Tenders by Dec. 9.

## NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

*No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.*

**COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.**

**Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.**

**Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.**

**TERMS OF SUBSCRIPTION to the "JOURNAL."**

**United Kingdom: One Year, 21s.; Half Year, 10s. 6d.; Quarter, 6s. 6d.**
Payable in Advance. If credit is taken, the charge is 25s. a year.

**Abroad (in the Postal Union): £1 7s. 6d., payable in Advance.**

All Communications, Remittances, &c., to be addressed to WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.
**Telegrams: "GASKING, LONDON." Telephone: P.O. 1571a Central.**


**OXIDE OF IRON.**

**O'NEILL'S OXIDE**
For GAS PURIFICATION.
LARGEST SALE OF ANY OXIDE.

**SPENT OXIDE PURCHASED IN ANY DISTRICT.**

GAS PURIFICATION & CHEMICAL CO., LD.
PALMERSTON HOUSE,
OLD BROAD STREET, LONDON, E.C.

**WINKELMANN'S**
**"VOLCANIC" FIRE CEMENT.**
Resists 4500° Fahr. Best for GAS-WORKS.
ANDREW STEPHENSON, 182, Palmerston House, Old Broad Street, London, E.C. "Volcanism, London."

**BROTHERTON & CO., LIMITED.**
Offices: Commercial Buildings, LEEDS.
Correspondence invited.

**PATENTS AND TRADE MARKS**
PUBLICATIONS, "MERCHANDISE MARKS ACT, and Decisions thereunder," 1s.; "TRADE SECRETS v. PATENTS," 6d.; "DOCTRINE of EQUIVALENTS, Mechanical and Chemical," 6d.; SUBJECT-MATTER of PATENTS," 6d.
MEWBURN, ELLIS, & PRYOR, Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C. Telegrams: "Patent London." Telephone: No. 243 Holborn.

**SPENT OXIDE.**
**THE South Metropolitan Gas Company** are always open to receive OFFERS of SPENT OXIDE.
Chief Office: 709, Old Kent Road, London, S.E.
Telegrams: "METROGAS, LONDON."

**SULPHATE OF AMMONIA**
SATURATORS and all LEAD and TIMBER WORK in Connection with Sulphate Plants.
We guarantee promptness, with efficiency for Repairs.
JOSEPH TAYLOR AND CO., CENTRAL PLUMBING WORKS, BOLTON.
Telegrams: SATURATORS, BOLTON. Telephone 0848.

**TAR AND LIQUOR WANTED.**
Best Prices paid.
DENT AND CO.,
Ouse Chemical Works, SELBY.

**J. & J. BRADDOCK (Branch of Meters** Limited), Globe Meter Works, OLDHAM, and 54 & 47, Westminster Bridge Road, LONDON, S.E.
WET AND DRY GAS-METERS, PREPAYMENT METERS, STATION METERS, AND GOVERNORS.
REPAIRS RECEIVE PROMPT ATTENTION.
Telephones: 254 Oldham, and 2412 HOP, London.
Telegrams:—
"BRADDOCK, OLDHAM," and "METRIQUE, LONDON."

**DUTCH OXIDE OF IRON.**

**SPENT OXIDE PURCHASED IN ANY DISTRICT.**

**THE First Dutch Bogore Co., Ltd.,** HOLLAND.
*General Manager (for England and Wales)—*
CHARLES E. FRY, LEAMINGTON.
*General Manager (for Scotland)—*
J. B. MACDERMOTT, 11, Bothwell St., GLASGOW.

**GAS TAR wanted.**
BROTHERTON AND CO., LTD., Tar Distillers.
Works: BIRMINGHAM, GLASGOW, LEEDS, LIVERPOOL, AND WAKEFIELD.

**HYDRATED OXIDE OF IRON.**
**PREPARED from Pure Iron.**
Twice as Rich as Bog Ore.
Gives no Back Pressure.
The Cheapest in the Market.
Can be Exchanged for Spent Oxide.
READ HOLLIDAY AND SONS, LTD., HUDDERSFIELD.

**"NUGEPE" GAS PLANT CEMENT.**
**JOHN E. WILLIAMS AND CO.,**
LOWER MOSS LANE,
MANCHESTER, S.W.
For all Joints in connection with Oil-Gas Plant and Sulphate Plant.
For all Gas Joints.
For all Tar Joints.
For all Ammonia Joints.

**THE KEITH LIGHT.**
OVER 2000 INSTALLATIONS IN DAILY USE.
**SEE illustrated advertisement in next** week's issue.
JAMES KEITH AND BLACKMAN CO., LTD., 27, Farringdon Avenue, LONDON, E.C.

**OXIDE OF IRON.**
(NATURAL.)
**BALE & CHURCH will be pleased to** send Quotations and Samples on application.
SPENT OXIDE PURCHASED.
BALE'S FIRE CEMENT for all Retort and Furnace work.
PAINT for Gasholders, Purifiers, &c.
5, CROOKED LANE, LONDON, E.C.

**SULPHURIC ACID.**

**SPECIALLY prepared for the Manu-**facture of SULPHATE OF AMMONIA
**SPENCER, CHAPMAN, & MESSEL, LTD.**
(with which is amalgamated WM. PEARCE & SONS, LTD.,
36, Mark Lane, LONDON, E.C. Works: SILVERTOWN.
Telegrams: "HYDROCHLORIC, LONDON."
Telephone: 341, AVENUE.

**SULPHURIC ACID for Sale, specially** suitable for making Sulphate of Ammonia.
BROTHERTON AND CO, LTD., Chemical Manufacturers
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

**GLASS SHADES of every description,** for all kinds of Interior **GAS LIGHTING.**
Illustrated sheets on application.
**JOHN WALSH WALSH,**
SOHO AND VESTA GLASS WORKS, BIRMINGHAM.
Telegrams: "VESTA, BIRMINGHAM."
National Telephone: No. 63.
London Show-Room: 4, HOLBORN CIRCUS, E.C.

**TO WATER AND GAS COMPANIES REQUIRING CAPITAL.**
**THE Water and Gas Debenture Share** Investment Trust, Limited, of 37, High Street, Tunbridge Wells, are prepared to Invest £10,000 Capital in above, and also to Underwrite Progressive Water and Gas Companies' issues.

**GAZINE—A radical Solvent and Pre**ventative of Naphthalene deposits, which has been used for many years on the Continent for the cleaning of Mains and Services, and is now being adopted in England. It is also used for the Enrichment of Gas, and has an Illuminating Value of double that of 90 per cent. Benzol.
Supplied by C. BOURNE, 120, Manor House Road, NEWCASTLE-ON-TYNE.

**ROBERT DEMPSTER & SONS, Ltd.,** Contractors for Complete CARBONIZING PLANTS and every description of GAS APPARATUS and ELEVATING and CONVEYING PLANT, Rose Mount Iron-Works, Elland.

**AMMONIACAL Liquor wanted.** Brotherton and Co., Ltd., Ammonia Distillers. Works: Birmingham, Glasgow, Leeds, Liverpool, and Wakefield.

**SITUATION Wanted by a good all-**round CLERK, with Five Years' Experience in Gas and Water Offices. Good References.
Address, R. A. Price, Bronhaul, Denbigh, N.W.

**SITUATION wanted as Manager of** Works, from 10 to 20 Millions, in South or Midlands. Thoroughly Practical, Total Abstainer, Good Testimonials, Age 30.
Apply, in first instance, to Mr. A. Richards, Gas Manager, Brewood, Staffordshire.

**SITUATION wanted as Assistant-**ENGINEER or MANAGER of Medium Sized Gas-Works. Thorough training in large modern Works. Good Chemist and Draughtsman. Eight Years practical Experience in Gas-Works Management and Routine, and Erection and Starting of New Plant, &c.
Address No. 4507, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

**SITUATION Wanted as Assistant** MANAGER or WORKS FOREMAN. Age 24. Experienced in Adjusting and Working Regenerative Settings, Slopers, Horizontals, and Machine Stokers, Water-Gas Installations, Sulphate and Ammonia Concentrating Plants, and General Gas-Works Construction. Good Chemist and Draughtsman.
Address, S. J. B. Tully, 2, Pembroke Road, New Southgate.

**MAINTENANCE.—Capable and trust-**worthy young MAN wanted. Must thoroughly understand his work. Permanent.
Apply, by letter, to No. 4514, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

**WANTED, an Experienced and Reliable** GAS-FITTER, well acquainted with House Fittings and a competent Meter Reader, in a country town. Must write a good hand, and be able to correctly keep ordinary and slot meter reading books.
Apply, stating Age, Wages required, with References, to No. 4509, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

**SHOW-ROOM ATTENDANT.**

**A GAS Company near London requires** the services of an Experienced SALESWOMAN, with a knowledge of Stoves, Fittings, Burners, &c.
Applications, stating Salary required, Age, &c., to No. 4513, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

**WANTED for a Gas-Works in South** America, an ASSISTANT-MANAGER or FOREMAN. Must be well acquainted with the routine of Works Management and especially of Carbonization, including Regenerators and Carburetted Water Gas.
For Particulars of Salary, &c., apply to No. 4516, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

**WANTED, a competent Man to take** Charge of two Vertical Boilers, two Exhausters, Washer-Scrubber, and Tar and Liquor Pumps. Duties (Twelve hours on and Twelve off) include Firing and keeping all Boiler and Machinery Fittings and Bearings clean and in good order. Must be able to pack, reduce brasses, &c., &c.
Apply, by letter only, stating Wages required, to A. G. Readdy, Secretary, Gas-Works, Hoylake.

**RUABON WATER COMPANY.**
**RHOS GAS COMPANY, LIMITED.**

**WANTED, a working Manager for the** above Companies.
Applicants must have had Experience in regard to Water Supply, and be thoroughly conversant with the Manufacture and Distribution of Gas.
The Water Supply is by gravitation; and the annual make of Gas is 10 to 11 Million cubic feet.
Salary, £2 per week, with House, Coal, Gas, and Water.
Applications, accompanied by not more than three Testimonials of recent date, to be sent to the undersigned, on or before the 13th of December next.
George E. Woodford,
Secretary.
Ruabon, Nov. 25, 1905.

**WANTED, New or Second-Hand** Travelling TANKS-WAGGONS for Gas Liquor.
Address No. 4515, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

**WANTED to Purchase, Gas Carbon** delivered at nearest Station to Gas-Works, in quantities of not less than Four Tons.
State Price to No. 4512, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

**WANTED, Second-Hand Cast-Iron** RETORT MOUTHPIECES, self-sealing preferred, of ∩ section, and 18 in. by 14 in. or 18 in. by 15 in. internal measurements, in Sets of Eights, with Sockets for 6-inch Ascension Pipes. Must be in good condition and cheap.
Full Particulars and Prices to No. 4511, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

**WANTED to Purchase, any good** Second-Hand GAS PLANT and CONNECTIONS for Gas-Works of about 6 Million cubic feet. It is essential that it should be in excellent condition.
TENDERS are likewise required for the supply and erection of a COMPLETE GAS-WORKS, capable of turning out 6 Million feet per annum.
Full Particulars to the Gas and Water Works Supplies and Construction Company, Limited, 99, Cannon Street, London, E.C.

**THE Sutton-in-Ashfield Urban District** Council have for SALE 220 COPPER STREET LAMPS and CAGES.
TENDERS are invited for the whole or any portion.
Full Particulars may be obtained from Mr. Thos. Robinson, Gas-Works Manager.

**GAS PLANT for Sale—I can always offer** NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters. Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
J. F. Blakeley, Gas Engineer, Thornhill, Dewsbury.

**BRIDGEWATER COLLIERIES COKE-WORKS.**
(The Earl of Ellesmere.)

**TENDERS are invited for the Tar pro-**duced at the above Works for a period of Six or Twelve Months from the 1st of January, 1906, delivered into Contractor's Tanks at the Bridgewater Colliery Siding, Wharton Hall, on the Pendleton and Hindley Branch of the Lancashire and Yorkshire Railway; or at the Brackley Siding, Little Hulton Mineral Branch of the London and North-Western Railway.
The estimated quantity is about 2600 Tons per annum.
Tenders, endorsed "Tender for Tar," to be addressed to Mr. Thomas M. Brown, Bridgewater Coal Offices, 4, Chapel Walks, Manchester, not later than the 27th of December.
Manchester, Nov. 28, 1905.

**OXIDE SHED.**

**THE Gas Committee of the Coventry** Corporation invite TENDERS for the supply and Erection, at their Foleshill Works, of an OXIDE SHED, 322 ft. long by 62 ft. 6 in. wide, formed of Cast-iron Columns and Steel Roof covered with corrugated sheets.
Specification and Form of Tender, with Bill of Quantities, may be obtained on application to the undersigned, and Prints of the Drawings will be supplied on payment of One Guinea, which will not be returned.
The Committee do not bind themselves to accept the lowest or any Tender.
Tenders must be delivered not later than the first post on Monday, the 18th of December, addressed to the Chairman of the Gas Committee, Gas-works, Coventry, and endorsed "Tender for Oxide Shed."
Fletcher W. Stevenson,
Engineer and General Manager.
Gas-Works, Coventry.
Nov. 29, 1905.

**RAMSGATE CORPORATION.**
(Gas Department.)

TENDERS FOR CONDENSERS AND LIVESEY WASHER.

**THE Gas and Water Committee invite** TENDERS for the Supply, Delivery, and Erection at their Gas-Works, of a set of VERTICAL WATER-TUBE CONDENSERS and a LIVESEY WASHER.
Specifications and Forms of Tender may be had on application to the undersigned.
Separate Tenders, sealed and endorsed "Condensers" or "Washer," to be addressed to the Chairman of the Gas and Water Committee, Gas and Water Offices, Boundary Road, Ramsgate, and delivered on or before Saturday, Dec. 9, 1905.
The Committee do not bind themselves to accept the lowest or any Tender.
T. N. Ritson, Assoc.M.Inst.C.E.,
Engineer and Manager.
Gas and Water Offices, Boundary Road,
Ramsgate, Nov. 24, 1905.

**NEWPORT (MON.) GAS COMPANY.**

**THE Directors of the Newport (Mon.)** Gas Company are prepared to receive TENDERS for the WORKS hereinafter described to be carried out at their Crindau Gas-Works, Newport, Mon.—viz:
Contract No. 1.—Extension of existing Retort-House, raising walls of Building, and Roof, Construction of Siding, and alteration of Existing Sidings.
Contract No. 2.—Construction of Regenerative Retort-Settings (Horizontal) of 216 Mouthpieces, with all Mains, Fittings, Stage Floor, Coal-handling plant, comprising Coal Breaker, Elevator, Conveyor, Hoppers, Waggon Tipping Travelling Crane, Capstans, and Motors.
Contract No. 3.—Coke-handling plant, comprising Telpher System, Coke Trams and Narrow Gauge Railway.
Contract No. 4.—Gas Engines and Plant for Generating and Distributing Power on Works.
Contract No. 5.—A Set of Six Purifiers with Valves, Connections, and Shed.
Drawings and Specifications may be seen on application to Mr. Thos. Canning, Assoc.M.Inst.C.E., the Engineer, Gas-Works, Mill Street, Newport (Mon.), on and after the 11th day of December, 1905, and Copies of the Specification, Schedule, and Form of Tender can be obtained on receipt, by the undersigned, of Five Guineas, which will be returned when a *bond-fide* Tender is received.
Tenders, addressed to the Chairman of the Company, to be lodged with the undersigned on or before Wednesday, the 3rd of January, 1906, Sealed and Endorsed as directed under the Specifications for each portion of the works.
The Directors do not bind themselves to accept the lowest or any Tender.
T. H. Hazell,
Secretary.
Gas Offices, Mill Street,
Newport, Mon., Nov. 30, 1905.

**ISLE OF THANET GASLIGHT AND COKE COMPANY, MARGATE.**

**THE Directors of the above Company** are prepared to receive TENDERS for the EXCAVATION OF ROADS, and the LAYING OF GAS MAINS.
Particulars may be obtained from the undersigned.
Tenders, endorsed "Excavation," to be addressed to the Chairman of this Company, and to be received not later than Thursday, Dec. 14 next.
Frank A. Winstanley,
Engineer and Manager.
The Offices, The Dane,
Margate.

**HECKMONDWIKE GAS COMPANY.**

**THE Directors of the above Company** invite TENDERS for the purchase of surplus TAR and AMMONIACAL LIQUOR produced at their Works during the Twelve Months ending December 31, 1906.
Particulars and Conditions of Contract may be obtained from the Manager, Mr. F. D. Richmond.
Tenders, endorsed "Tar and Liquor," to be addressed to the Chairman, Mr. J. J. Stead, and sent in not later than Dec. 18, 1905.
The Directors do not bind themselves to accept the highest or any Tender.
By order,
E. Benn, Secretary.

**MALVERN URBAN DISTRICT COUNCIL.**

TAR.

**THE above Council are prepared to re-**ceive TENDERS for the purchase of the surplus TAR produced at their Gas-Works for the ensuing Twelve Months.
Particulars can be obtained from Mr. W. J. Rendell Baker, Engineer and Manager, Council Offices, Malvern.
Sealed Tenders, endorsed "Tender for Tar," to be delivered to the undersigned not later than Twelve o'clock noon on Tuesday the 12th day of December, 1905.
The Council do not bind themselves to accept the highest or any Tender.
H. L. Whatley,
Clerk to the Council.
Council Offices, Malvern.

**COUNTY BOROUGH OF ROCHDALE.**

TO OIL IMPORTERS AND OTHERS.

**THE Gas and Electricity Committee of** the above Corporation are prepared to receive TENDERS for the supply, during a period of Six Months commencing Jan. 1, 1906, of about 500 Tons of OIL for the Manufacture of Carburetted Water Gas. The Oil to have a flashing point of not less than 73°, Abel's Test.
Sealed Samples and Analysis of the Oils offered must be sent to Mr. T. Banbury Ball, the Manager at the Gas-Works, Dane Street, from whom any further Information may be obtained.
The Prices should be quoted per imperial gallon, and must include delivery in sellers' tanks at the Milnrow Road Sidings of the Lancashire and Yorkshire Railway Company at Rochdale.
Sealed Tenders, endorsed "Gas Oil," addressed to the Chairman of the Gas and Electricity Committee, must be sent in to me before noon on Wednesday, Dec. 13, 1905.
By order,
Wm. Henry Hickson,
Town Clerk.
Town Hall, Rochdale,
Nov. 30, 1905.

**THE BOURNEMOUTH GAS AND WATER COMPANY.**

ISSUE OF £10 SEVEN PER CENT. "B" SHARES. MINIMUM PRICE OF ISSUE, £15 PER SHARE.

Sale by Tender of 2000 £10 Seven per Cent "B" Shares in pursuance of the provisions of the Bournemouth Gas and Water Act, 1896.

**NOTICE is Hereby Given, that it is the** intention of the Directors of this Company to SELL by TENDER 2000 "B" SHARES of £10 each (the Dividend on which is limited to £7 per cent.), to be paid up in full on or before the 14th of February, 1906.
The Company are now engaged in the erection of new Gas-Works at Poole, with all the latest Improvements, and the Capital now offered is required for this purpose, and also for extension of the Company's existing Works and Plant, to enable them to meet the increased demand for Gas and Water by reason of the continued development of the District supplied by the Company. The Dividend on the Original Shares for the half year ended the 30th of June, 1905, was at the rate of 10 per cent. per annum, with an addition at the rate of 4 per cent. per annum under the Sliding-Scale, and on the "B" Shares at the rate of 7 per cent. per annum. Since the 31st of December, 1888, to the 31st of December, 1903, the Dividend on the Original Shares has been at the rate of 13 per cent. per annum, and subsequently at the rate of 14 per cent.
The net profit earned in the year ended the 30th of June, 1905, after deducting all charges, including Debenture and other interest, amounted to £31,998 7s. 2d. During the same twelve months the sum of £2000 was added to Reserve Fund from Profits, and also £704 8s. 6d. from interest on Reserve Investments; and after payment of Dividends to the 30th of June, 1905, and writing off in respect of Poole Works on account of Works demolished £3000, and for re-sheeting gasholder £500, together £3500, the sum of £6350 4s. 10d. remained to be carried forward to the current half year.
Particulars and Conditions of Tender may be obtained at the Company's Offices, Bournemouth and Poole, or of the Secretary as under.
Sealed Tenders must be sent to the Secretary not later than Eleven o'clock on Thursday morning, the 14th of December, 1905.
By order,
William Cash,
Secretary.
London: 90, Cannon Street, E.C.
Nov. 21, 1905.

**TOTTENHAM AND EDMONTON GASLIGHT AND COKE COMPANY.**

NOTICE is Hereby Given, that the TRANSFER BOOKS of the Company, so far as they relate to DEBENTURE STOCK, WILL BE CLOSED at Ten o'clock in the forenoon on Friday, the 8th of December for the Half Year ending the 31st of December, 1905, and will be RE-OPENED on Friday, the 15th of December.

The Interest for the Half Year will be payable on the 1st day of January next to the Proprietors registered on the closing of the Books.

By order of the Board,
JAMES RANDALL,
Secretary.

Chief Offices: 639, High Road,
Tottenham, Dec. 1, 1905.

**THE GASLIGHT AND COKE COMPANY.**

NOTICE is Hereby Given, that the TRANSFER BOOKS of this Company, so far as they relate to DEBENTURE STOCK and BONDS, WILL BE CLOSED at One o'clock p.m. on Saturday, the 9th prox., for the Half Year ending on the 31st prox., and will be RE-OPENED on the morning of Monday, the 11th prox.

The Interest for the Half Year will be payable on the 1st of January next to the proprietors registered on the closing of the Books.

By order,
HENRY RAYNER,
Secretary.

Chief Office: Horseferry Road,
Westminster, S.W., Nov. 28, 1905.

**ISSUES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.**

MR. ALFRED RICHARDS begs to notify that his ISSUES by AUCTION under PARLIAMENTARY POWERS of STOCKS and SHARES in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.

Terms for Issuing such Capital, and also for including Gas and Water Stocks and Shares belonging to Private Owners in these Periodical Sales, can be obtained on application at MR. ALFRED RICHARDS' OFFICES, 18, FINSBURY CIRCUS, E.C.

**GILBERT LITTLE & CO.LTD.**

*Conveyor and Elevator Specialists,*
**Smethwick, Birmingham.**

Make known your wants for Conveyors and Elevators to GILBERT LITTLE, the Pioneer Specialist; he will supply them.

**HEATHCOTE GAS COAL.**

**Rich in Illuminating Power and yield of Gas.**

**Above the Average in Weight and Quality of Coke.**

**Maintains a High Standard in Residuals.**

**THE GRASSMOOR CO., LD.,**
**CHESTERFIELD.**

*Now Ready, Price 15s., Limp Cloth.*

**TWENTY-FIFTH YEAR.**

AN

**ANALYSIS OF THE ACCOUNTS**

OF THE

**METROPOLITAN WATER COMPANIES**

(Chelsea, East London, Grand Junction, Kent, Lambeth, New River, Southwark and Vauxhall, and West Middlesex),

AND OF THE

ACCOUNTS OF SOME OF THE PRINCIPAL

**PROVINCIAL WATER UNDERTAKINGS**

FOR THE YEAR 1904-1905.

**Compiled by**
**WOOD, DREW, & CO.,**
**Chartered Accountants.**

LONDON:
WALTER KING, 11, Bolt Court, FLEET STREET, E.C.

**THOMAS DUXBURY & CO.,**
**16, DEANSGATE, MANCHESTER.**

Best Gas Coal and Cannel, giving High Illuminating Power, Large Yield per ton, and reasonable in Price.

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**Telephone 1806.**

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PATENT
**CANDLE SAFETY LAMPS.**

**Are a great improvement on Oil, giving a good Light, requiring little or no Cleaning, and when once lighted no further attention is necessary. The Candles are made to burn 5, 7, or 9 hours.**

48, MANCHESTER STREET, GRAY'S INN ROAD, W.C.

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**SHEAF WORKS, SHEFFIELD,**
MANUFACTURERS OF
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**FOR ENGINEERS.**
**STEEL OF ALL DESCRIPTIONS.**
SCREW STOCKS, TAPS AND DIES, SPANNERS, RATCHET BRACES, LIFTING JACKS ANVILS, VICES, AND ENGINEERS' TOOLS GENERALLY.
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**TROTTER, HAINES, & CORBETT**
BRETTELL'S ESTATE LIMITED,
**FIRE-CLAY & BRICK WORKS,**
**STOURBRIDGE.**

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.

**Special Lumps, Tiles, and Bricks for Regenerative and Furnace Work.**

SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

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**UNEQUALLED.**
**Sperm Value 878·85 lbs. per Ton.**

*Please apply for Prices, Analyses, and Reports, to the*

**MIRFIELD (GAS COAL) COLLIERIES**
**RAVENSTHORPE, NEAR DEWSBURY.**
**LONDON: 22, Park Village East, N.W.**

**NEWBATTLE CANNEL.**

**Highest Results in Gas, & Excellent Coke.**

QUOTATIONS ON APPLICATION TO
**THE LOTHIAN COAL COMPANY,**
LIMITED,
**NEWBATTLE COLLIERIES,**
**DALKEITH, N.B.**

**JAMES OAKES & CO.,**
**ALFRETON IRON-WORKS, DERBYSHIRE,**
AND
**Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.**

Manufacture and keep in Stock at their Works (also large Stock in London)

PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS, and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with Bolts, Nuts, and Covers, and rendering Leakage impossible.

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**CLIFF'S BRAND.**
**INGHAM'S BRAND.**

**Fire-Bricks, Lumps, Tiles, &c., &c., of every description suitable for Gas-Works.**

**Patent MACHINE-MADE RETORTS**

These Patent Machine-Made Retorts possess the excellent quality of remaining as near stationary as possible under the varying conditions of their work—a quality which will be appreciated by all Gas Engineers and Managers. The generally expressed opinion is that these Retorts are the very best that are made. *Retorts carefully Packed for Export.*

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ESTABLISHED 1860.

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**KLONNE SETTINGS A SPECIALITY.** High-Class Work Only.

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**ENGINEERS,**
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*COAL AND COKE STORAGE PLANTS.*
**Coal and Coke Elevators and Conveyors.**
**STAMPED AND RIVETTED STEEL ELEVATOR BUCKETS.**
DETACHABLE CHAINS AND SPROCKET WHEELS.
HIGH-CLASS STEAM ENGINES. BEAM PUMPING-ENGINES, &c.

**TIMMIS'S PATENT**
**CLINKERING DOOR.**

For Illustrated Advertisement, with full Particulars, see "JOURNAL" for April 4, p. 66.

**GEO. H. TIMMIS,**
**River Stour Works, STOURBRIDGE.**
Telegrams: "TIMMIS, LYE." National Telephone: 13, LYE.
or of **HARPER & MOORES, LTD.,**
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**UNBREAKABLE**
**INCANDESCENT MANTLE**
Made in England, by a secret process, from 3-ply Ramia, and strengthened to prevent breakage, 100-Candle power.
OUTSHINES & OUTLASTS ALL OTHERS.
**Sample Dozen, post free 3/6.**
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**"SIMPLEX" PREPAYMENT METER.**

**NO REMOVAL OF METER.**

NO Seals to hack out.
NO Screw Head to find.
NO reaching over Meter.
NO Numbers to look for.
NO Re-screwing.
NO Re-sealing.
NO bent Coin that is inserted into the Mechanism will jamb it.
NO second Coin can be inserted until previous one released by turning the handle.

**TO CHANGE PRICE**
merely unlock Padlock of Money Box, lift Flap at side, and change wheel.
**THIS CAN BE DONE IN 30 SECONDS.**

The Valve can be readily taken out to remove obstructions at any time without taking Meter down.

**ALL BRASS AND GUN-METAL MECHANISM.**

Ordinary and Prepayment Meters can be converted into SIMPLEX Prepayment or Convertible Stops.

**QUOTATIONS ON APPLICATION.**

**METROPOLITAN GAS METERS, LIMITED,**

*Works and Offices:*
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Telegraphic Address "GASOMETER, LONDON."
Telephone: 204 X NOTTINGHAM.

*London Depot:*
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Telephone: 2044 HOP.

# Are YOU getting YOUR SHARE of the Block Light Business?

If you are not getting a large business in Block Lights your competitor most surely is, for an enormous number of Block Lights are being sold in every part of the country.

Full page advertisements in the "Daily Mail," "The Daily Express," many other large London dailies, as well as the most influential provincial papers, are only part of our extensive advertising in newspapers and magazines. We are telling your customers about the Block Light, and we have succeeded in making it the most popular and most talked of light in the United Kingdom.

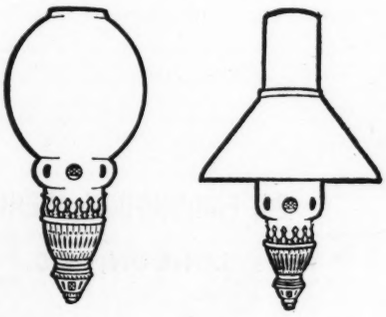
Are you reaping the benefit?

Are you getting your share of the profit or is your competitor?

The Block Light pays 33⅓ per cent. profit to you. It sells quickly because it is well advertised; it gives satisfaction to your customers because it is a good light and saves them money on their gas bills. It is a well-known fact that if you sell a family one Block Light many repeat orders follow, and that is the kind of article every wideawake dealer is looking for.

## WHY THE BLOCK LIGHT GIVES SATISFACTION.

One Block Light gives a light which is equal to that given by four incandescent burners of the ordinary kind. Each of these four burners would consume 4 feet of gas per hour, or 16 feet in all, while one Block Light burner with a single mantle will consume 6 feet of gas. The Block Light thus saves the cost of 10 feet of gas per hour, and gives a better light. Every time the gas bill is sent to a home that has changed from ordinary lights to Block Lights, it reminds your customer of the saving effected.



The Block Light can be obtained from:—

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Catterson & Co.
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# GAS VERSUS ELECTRICITY.

THE **STAR**

Gives 70-Candle Power

With a Consumption of 2½ cub. ft. of Gas per hour, with a 1-inch Mantle.

**Each Mantle Ring bears the Reg. No. 427,544.**

**All Mantles stamped "STAR."**

Otherwise none genuine.

**BEWARE OF IMITATIONS.**

Write for **LISTS** and **DISCOUNTS.**

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# Gasholders.

## GAS PLANTS.

# Steel Pipes,

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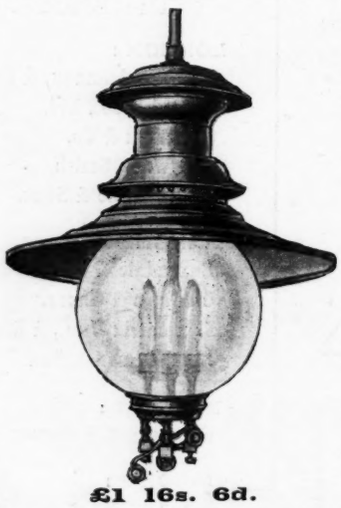
# POND & CO.

Guarantee the Lamp as shown to be **Equal** in **Light** and **Durability** to **any other Lamp on the Market** (**imported** or otherwise), and will, without doubt, be existing when some others are "in the air" (a sample will prove).

*ADVANTAGES.*

Noiseless.
No Springs.
Economical.
No Stuffing Boxes.
High Power. Low Pressure.



*ADVANTAGES.*

Windproof.
Syphon at Bottom.
Globes cannot break from expansion.
2 or 4 Burners may be used.
Cock well away from heat, at base.

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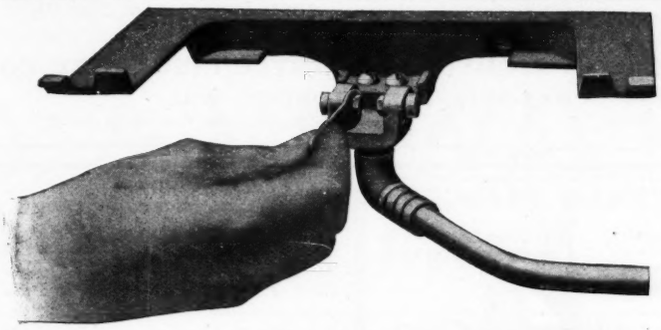
**£1 16s. 6d.**

Manufacturers and Patentees of the "Wis" High-Power Lamp, The "Dwarf Wis" Lamp (for low ceilings), &c.

# The Latest Word of skill and Science in Gas-Fire Construction.



## Wright's Patent Adjustable Gas Injector.

Provisionally Protected 16th Aug., 1905.

**The Simplest and Newest Method** for securing **absolute control** in Gas Fires, so that **ideal combustion** is secured under every variety of conditions.

PERFECT ADJUSTMENT secured once for all by ONE SIMPLE MOVEMENT ONLY.

**A TURN OF A NUT DOES IT.**

This Patent can be fitted to all our Loose-Burner Gas-Fires without extra charge.

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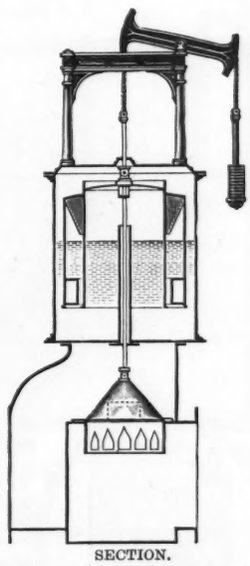
**The result of many years' varied experience in their design and manufacture, they effectually Control Pressure under the most exacting conditions.**

From a photo. of 30-inch Station Governor supplied to Aberdeen Corporation.



SECTION.

**The Bell is enclosed and in communication with the outlet of the Governor, thus responding to the slightest variation in outlet Pressure. Small weights are conveniently placed for operating the Governor, or "The Peebles' System of Air-Loading" from a distance may be employed. All Governors are carefully tested before being dispatched, and the material and workmanship is of the best possible description.**

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RETORTS CAREFULLY PACKED FOR SHIPMENT.

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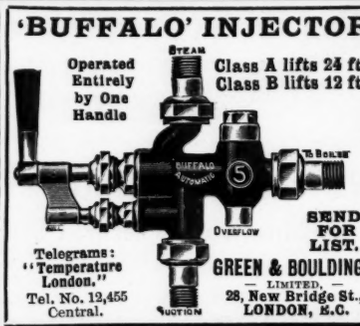


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**STATION METER.**
Efficiency Demonstrated.
*APPLY—*
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**HANNA, DONALD & WILSON, PAISLEY.**
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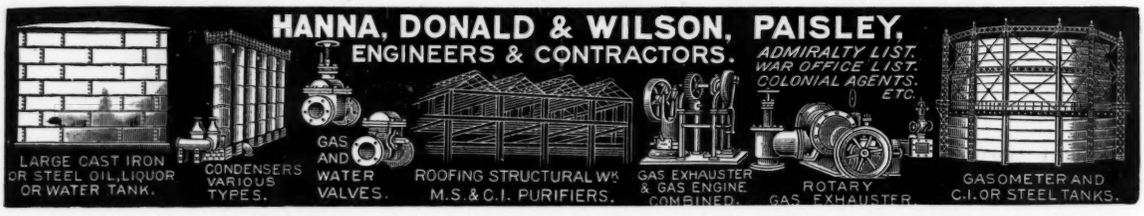
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M.S. & C.I. PURIFIERS.
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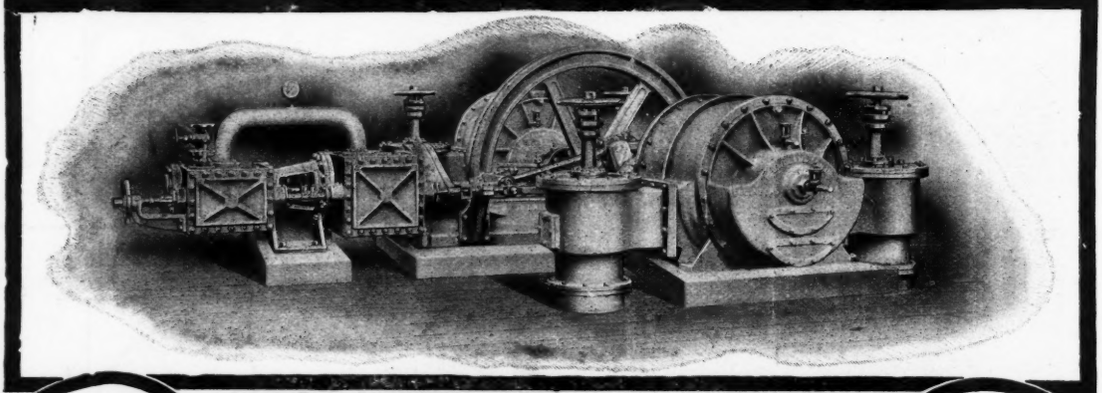

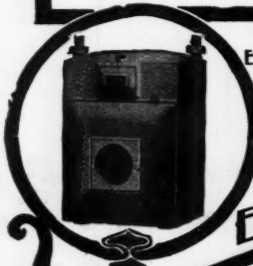

ONE OF FOUR SETS OF TWO EXHAUSTERS & HORIZONTAL TANDEM COMPOUND NON-CONDENSING STEAM ENGINE HAVING A TOTAL CAPACITY OF 1200000 CUB. FT OF GAS PER HOUR AT 80 REVS PER MIN. ERECTED AT NECHELLS GAS WKS. BIRMINGHAM.

SIMON SQUARE WORKS, EDINBURGH
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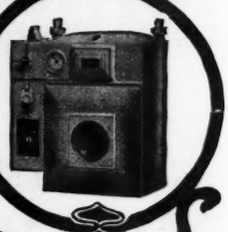

ALLIANCE FOUNDRY & · GLASGOW · ENGINEERING WORKS,

# MODERN GAS APPARATUS.

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**London Office:**
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**DONNINGTON, near NEWPORT, SALOP.**

## THE LUCAS LIGHT

### stands alone

in its unique simplicity and efficiency. It is the best self-intensive lamp because the results are obtained by the simplest means. It is the best because it is the lamp of highest duty.

MOFFAT'S LTD., 155, FARRINGDON ROAD, LONDON, E.C.

## THE SILICA FIRE-BRICK COMPANY.

**OUGHTIBRIDGE.**

# RADIATE MORE HEAT

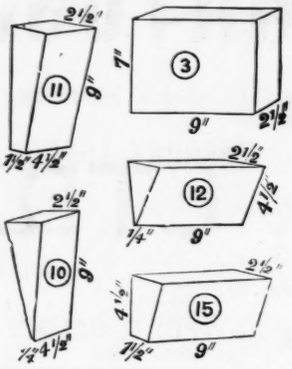
**BY USING**

# SILCO BRICK RETORTS.

**SILCO BRICKS prevent all settling of setting.**

**SILICA BRICKS for Combustion Chambers, any shape.**

# STEPHENS & CO., KIDWELLY.




*Contractors to a large number of the Principal Gas-Works.*

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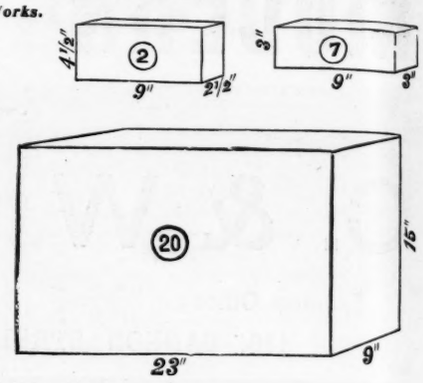
## SILICA BRICKS, BLOCKS, SHIELDS, TILES.

SPECIAL PLASTIC SILICA CEMENT.

Without doubt the finest Materials in the Market for Gas-Works Furnaces.

BRICKS, BLOCKS, TILES, & SHIELDS of any shape made to order.

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MAKERS OF

## GASHOLDERS & GAS PLANT.

PURIFIERS, SCRUBBERS, CONDENSERS, WASHERS, TANKS, VALVES, PIPES, LAMP-PILLARS, RETORT-FITTINGS, ETC.

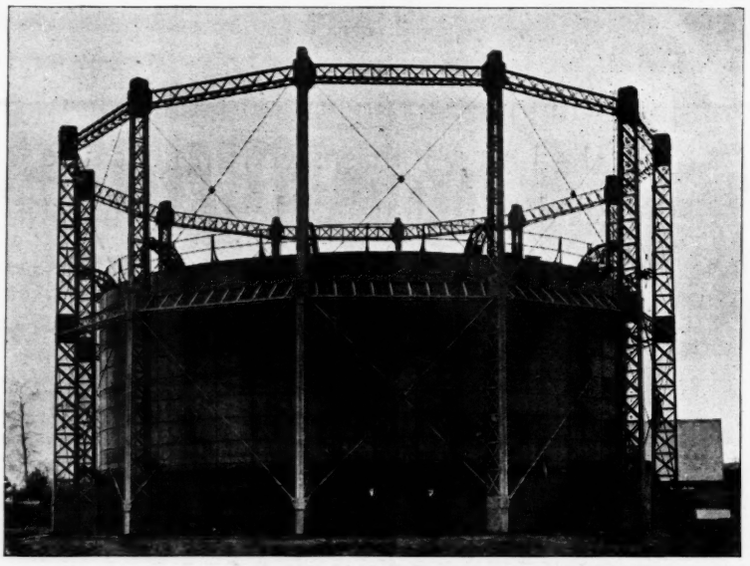
ALSO ALL KINDS OF

STRUCTURAL IRON AND STEEL WORK,

BRIDGES,

ROOFS.

PIERS, ETC.



WORKS & HEAD OFFICE:
TIPTON,
STAFFORDSHIRE.

LONDON OFFICE:
11, VICTORIA STREET,
WESTMINSTER.

TELEGRAPHIC ADDRESSES:
"HORSELEY, TIPTON."
"GALILEO, LONDON."

# F. C. SUGDEN & Co.

PHOTO. OF REGENERATOR SETTINGS DURING CONSTRUCTION.

## CARBONIZING SPECIALISTS.

**REGENERATOR & GENERATOR SETTINGS**

DEEP, SEMI-DEEP, AND SHALLOW.

**Maximum Make** per Ton and Mouthpiece.

**Minimum Fuel Consumption.**

**NUMEROUS REPEAT ORDERS**

Have been received for each of the above types of Settings.

RESULTS GUARANTEED. RETORTS RESET.

SOLE MAKERS OF **CRIPPS' PATENT CHIMNEY.**

Designs and Estimates on application.

28, EAST PARADE, **LEEDS.**

# BIGGS, WALL, & CO.,

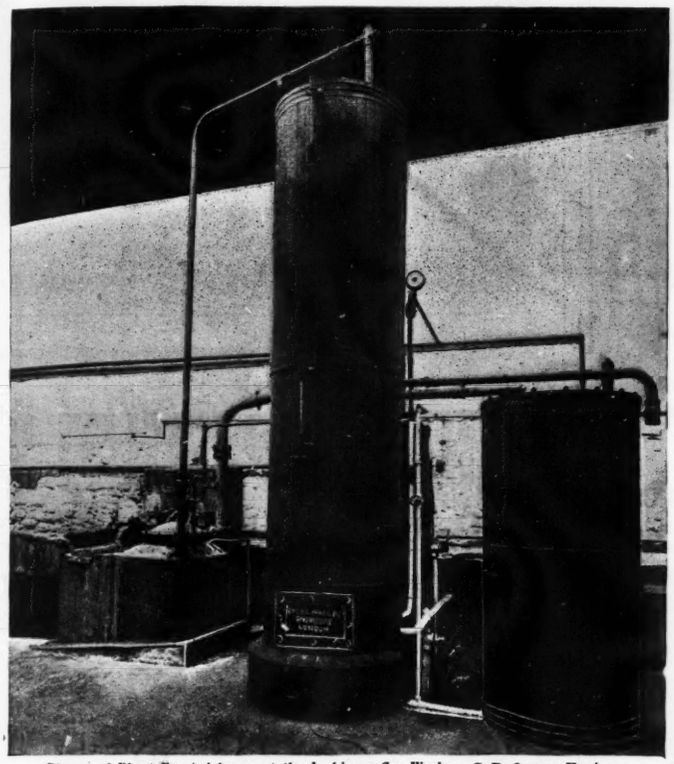


Photo. of Plant Erected by us at the Inchicore Gas-Works.—C. B. Ouron, Engineer.

**Gas Engineers and Chemical Plumbers,**

**13, CROSS ST., FINSBURY, LONDON.**

Telegraphic Address: "RAGOUT LONDON."

Telephone No. 273 CENTRAL.

**SPECIALITY:**

Sulphate of Ammonia Plants with our **Improved Still**, trays removable and easily cleaned, highest economy in working, splendid quality of salt (actual results in practice, 25·50 per cent. of ammonia), self-discharging Saturators and every modern improvement. **Lead Burners** sent anywhere on receipt of telegram, for urgent repairs.

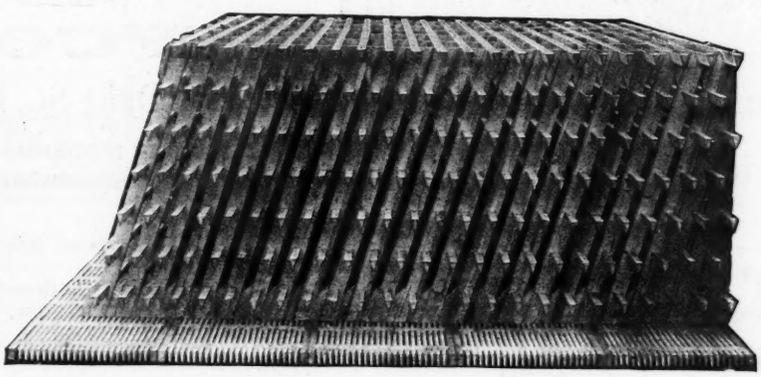
# SPENCER'S PATENT HURDLE GRID

**The very best Patent Grid on the Market for Holding Oxide Lightly,**

**And Holding Oxide Lightly is the Secret of Success for Better Purification.**

**No Extra Cost in adopting this system to existing Purifiers.**

**They are Self-Supporting, saving the cost of Standards and Bearers.**



**Can make the Change from the Old to the New System without any Stoppage.**

**Simple in Construction and very easy to fix in Position.**

**THE ADVANTAGES WITH SPENCER'S PATENT HURDLE GRID:**

1—They more than Double the Purifying Area of a given Purifier.
2—They can be filled in half the time as on any other Patent system.
3—Purifiers run much longer, Back pressure greatly reduced.
4—Purification much Improved at 25 per cent. less cost than by any other Patent method.

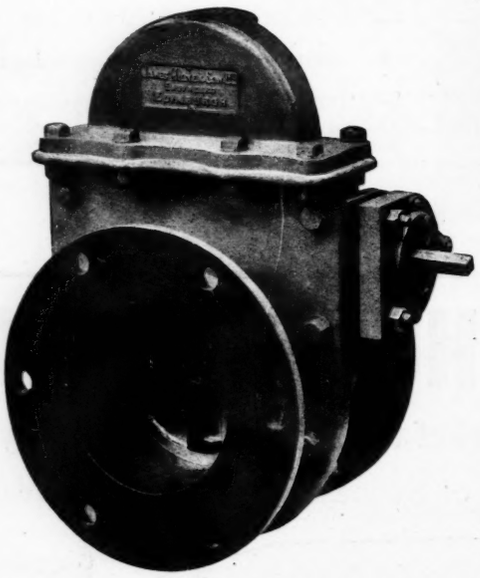
*P.S.—My Patent is no Infringement of any other Patents.*

# WALTER SPENCER, GRID WORKS, ELLAND.

# RACK & PINION GAS VALVES

USUAL SIZES IN STOCK.

FACES MACHINED THROUGHOUT.



**Valves and Seats Hand-Scraped.**

TESTED AT

15 lbs. per square inch.

MADE BY

**JAMES MILNE & SON**

LIMITED,

Milton House Works, EDINBURGH, . . .

Also at LONDON, GLASGOW, and LEEDS.

# TWO UNIQUE MANTLES.

**Give a brilliant Daylight effect.**

**Do not drop off or fall to pieces.**

Ensure pure air and clean ceilings with economy of Gas.

*Write for Trade Prices to the Manufacturers,*

**RAUM & CO.,**

25, Bartlett's Buildings, E.C.,

*or to Wholesale Agents,*

**EVERED & CO.,**

— LIMITED, —

27-35, Drury Lane, W.C.

THE

# "NEW PLANET"

## INVERTED LAMP.

FROM

**2/-**

Burner, Mantle, and Globe complete.

**To the Trade only**

Cheapest and most effective Burner made.

Genuine only if stamped "NEW PLANET."

**PIFCO, LTD.,**

72-76, Duke St., Liverpool.

PIONEERS OF MODERN GAS LIGHTING.

# THOMAS BUGDEN,

*India-Rubber, Guttapercha, Air-proof, and Waterproof Manufacturer,*

116 & 118, Goswell Road, LONDON.

Gas Bags for repairing Mains, Round Shape. All Seams Stitched and Taped.

Gas Bags for repairing Mains Cylinder Shape. All Seams Stitched and Taped.

Oilskin Clothing, Diving and Wading Dresses, Sewer Boots, Tar Hose, Stokers' Mitts, Bellows, &c.

Sewer and Fireman's Boots and Stockings

ORIGINAL MAKER OF

GAS BAGS FOR MAINS.

Contractors' and Miners' Woollen Jackets, Trousers, Hats, &c.

## HARRIS & PEARSON,

**STOURBRIDGE, ENGLAND,**

MANUFACTURERS OF

FIRE-CLAY GAS-RETORTS, FIRE-BRICKS, LUMPS, & TILES of Every Description.

GLAZED BRICKS AND PORCELAIN BATHS.

# REDUCED MAINTENANCE.

## A BOLD ASSERTION, to all whom it may concern.

We, **the G.I.C.,** undertake to effect a considerable saving in the cost of maintenance of Public and Private Lighting Installations, by supplying **MANTLES** of finest Ramie (in 15 sizes) from No. 2 Kern to 700-Candle Lucas. **Quality Guaranteed.**

Also **GLOBES, BULBS, CHIMNEYS,** and **PROTECTION GLASSES** of the finest Rock Crystal. **Guaranteed.**

**BURNERS** of all kinds, Novelties in Intensive and Inverted Lamps, and everything of the latest and best for Incandescent Lighting.

**PRICES.** We cordially invite inquiries for quotations and estimates, and finally guarantee to supply at cheaper rates than any other reputable House in the Trade.

Kindly write us for Prices and Compare.

## THE GENERAL INCANDESCENT COMPANY, LTD.

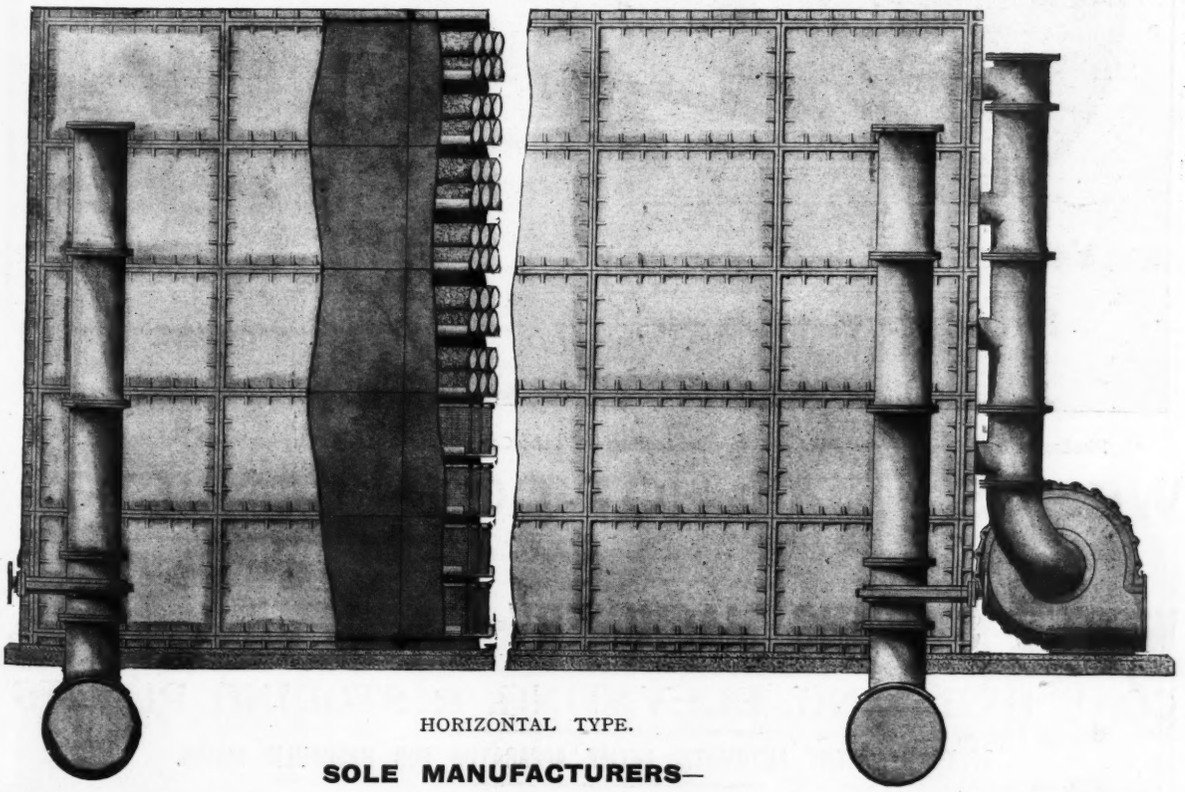
**(LONDON, BERLIN, NOTTINGHAM, and DERBY),**

**52, GREAT EASTERN STREET, LONDON, E.C.**

BROWNE & CHANDLER'S PATENT

# Vaporizing Condensers.

In these Air Condensers a greatly increased efficiency is secured by Internal Evaporation of a comparatively trifling quantity of water, with or without Fan draught.



HORIZONTAL TYPE.

**SOLE MANUFACTURERS—**

## MESSRS. W. J. JENKINS & CO., LTD., RETFORD.

ALBION IRON WORKS,
MILES PLATTING,

MANCHESTER.

TELEGRAMS—
"STOKER, MANCHESTER."

# WEST'S GAS IMPROVEMENT CO., LD.

*Gas and General Engineers.*

## CONTRACTORS FOR
# COMPLETE RETORT-HOUSE PLANT
EITHER ON
## THE HORIZONTAL OR INCLINED SYSTEMS.

Photograph showing West's Coke-Conveyor dealing with the Coke from Nineteen Through Beds of Retorts.

## WEST'S IMPROVED PATENT HOT-COKE CONVEYOR

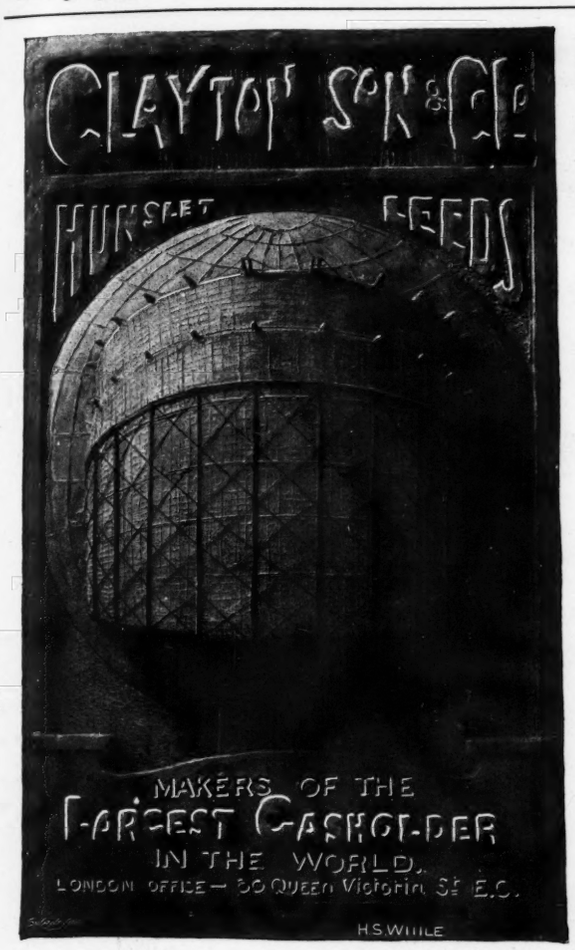
With Special Chain constructed with a minimum number of parts, and having Large Joint Pins with ample Bearing Surfaces.

## WEST'S STOKING MACHINERY—COMPRESSED AIR DRIVEN AND MANUAL SYSTEMS

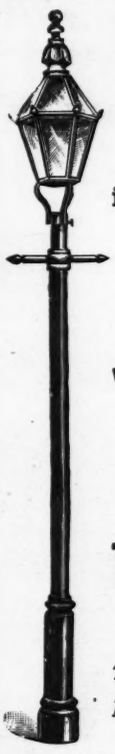
## COAL BREAKING, ELEVATING, & STORING PLANTS.

BELTON'S PATENT AUTOMATIC RELIEF APPARATUS FOR HYDRAULIC MAINS.

Manufacturers for America: Riter-Conley Manufacturing Company, Pittsburg.




# MANNESMANN



## LAMP POSTS

made throughout of
**WELDLESS STEEL TUBING**
including base, ring, and ladder rest.

***Light, Strong, Unbreakable, and Cheap.***

**GAS, WATER, & STEAM TUBES AND FITTINGS.**

**WELDLESS STEEL SPIGOT & FAUCET PIPES**
for Gas and Water Mains.

Tubes can be supplied up to 10 inches diameter and in lengths up to 40 feet.

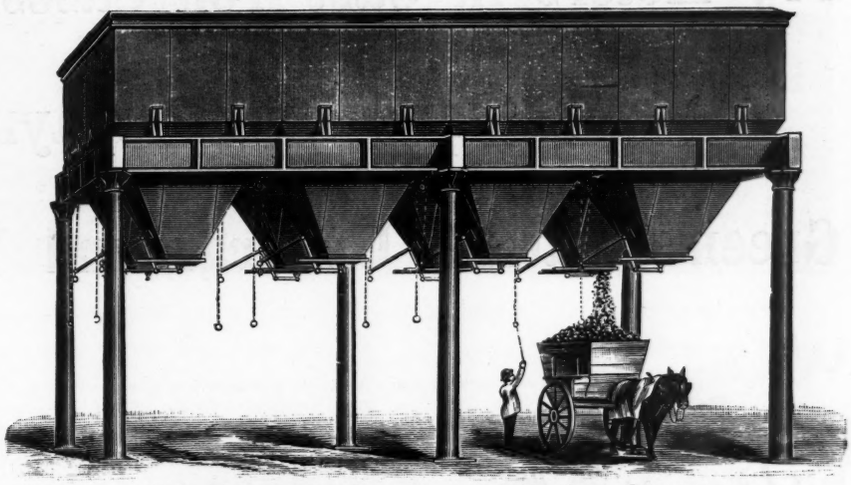
## THE BRITISH MANNESMANN TUBE COMPANY, LTD.,

**110, CANNON ST., LONDON, E.C.**

*Birmingham Depôt:* Bridge Works, LISTER ST.
*Works:* LANDORE, SOUTH WALES.

# R. & J. DEMPSTER, LTD.,
# OLDHAM ROAD, MANCHESTER.

**CONTRACTORS FOR ALL KINDS OF APPARATUS FOR DEALING WITH COKE, TAR, AND AMMONIA.**



Coke Storage, Elevators, Conveyors, Breakers, Screens.

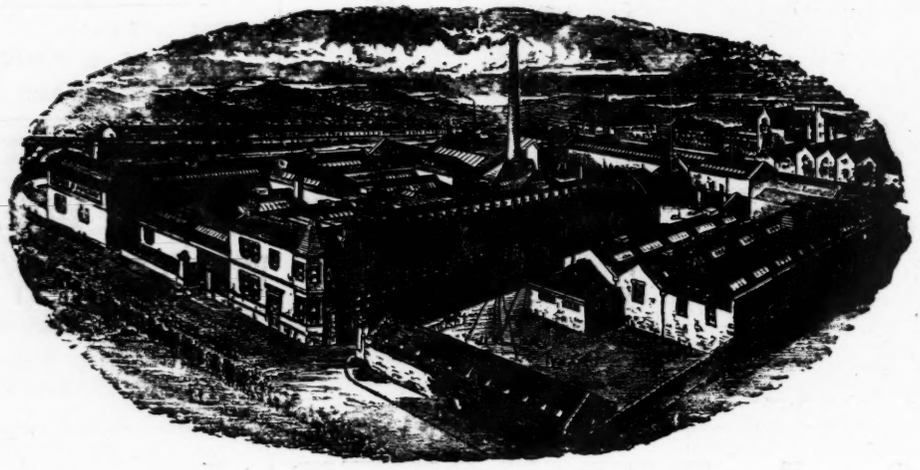
# PLANT FOR BYE-PRODUCTS EARNS DIVIDENDS.

**London Office: 165, GRESHAM HOUSE, OLD BROAD ST., E.C.**

# ALDER & MACKAY

**ESTABLISHED 1850.**

## GAS-METER MANUFACTURERS.



*SPECIALITIES.*

**Dry Meters in Cast-Iron Cases.**

**Wet and Dry Prepayment Meters.**

**Green's Patent Underground Wet Meters.**

NEW GRANGE WORKS, Telephone No. 81 Western. EDINBURGH.

Telegrams: "ALDER" EDINBURGH OR BRADFORD.

VENTNOR STREET WORKS, Telephone No. 1222. BRADFORD.

Central House, NEW STREET, BIRMINGHAM.

Telegraphic Address: "ALDERUGI, BIRMINGHAM."


Printed for WALTER KING by King, Sell, & Olding, Ltd.; and published by him at 11, BOLT COURT, FLEET STREET, in the CITY OF LONDON.—Tuesday, Dec. 5, 1905.

# CLARK'S RADIATORS.

SIMPLEST METHOD OF GAS RADIATION.

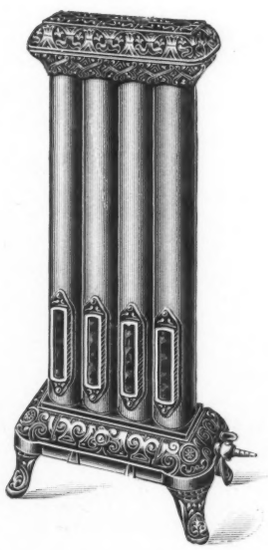
**TEMPERATURE RAPIDLY RAISED.**

ODOURLESS.

EFFECTIVE.

INEXPENSIVE.

ATTRACTIVE.



*Terms and full Particulars on application.*

**S. CLARK & CO.,**
**Compton Works,**
**Canonbury Road,**
**HIGHBURY,**
**LONDON, N.**

SEE OVER.

CLARK'S IMPROVED

# RADIATORS FOR GAS.

No. 77.

**Suitable for . .**
**HALLS,**
**SHOPS,**
**CORRIDORS,**
**Etc., Etc.**

No. 78.

No. 79.

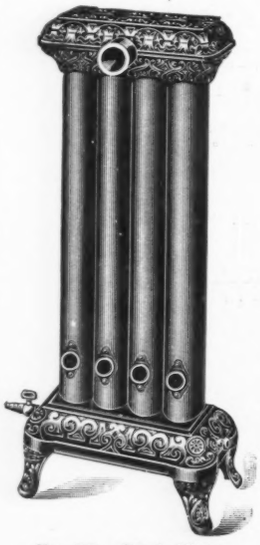
THIS Radiator is a simple heating apparatus, and can be fitted at the lowest possible expense. The heat is raised immediately, and can be regulated with the greatest facility. The gas being burned with a large admixture of air, the combustion is perfect and **no flue is required.**

**These Stoves are now fitted with Special Swivel Burners for facility of lighting. A match applied to any point of the open door ensures immediate ignition of all the burners.**

CLARK'S IMPROVED

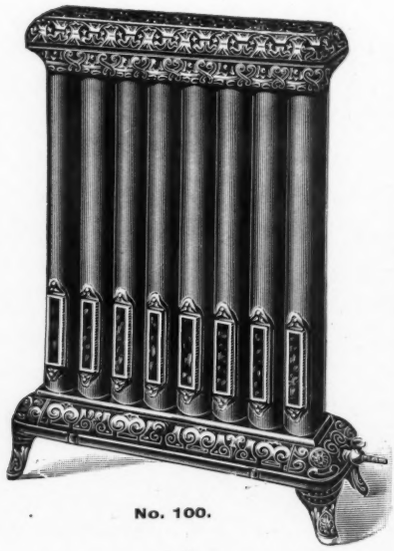
# RECUPERATIVE RADIATORS

## FOR GAS.



No. 98. Back View.

No. 99.



No. 100.

THE construction of the Recuperative Radiator is similar to above, but has, in addition, a generating chamber, heating the air from the exterior of the stove and delivering it from the top. This stove can be attached to a flue pipe, but as the combustion is perfect this is not necessary except when used in Bedrooms and such places.

Printed for WALTER KING by King, Sell, & Olding, Ltd.; and published by him at 11, BOLT COURT, FLEET STREET, in the CITY OF LONDON.—Tuesday, Dec. 5, 1905.